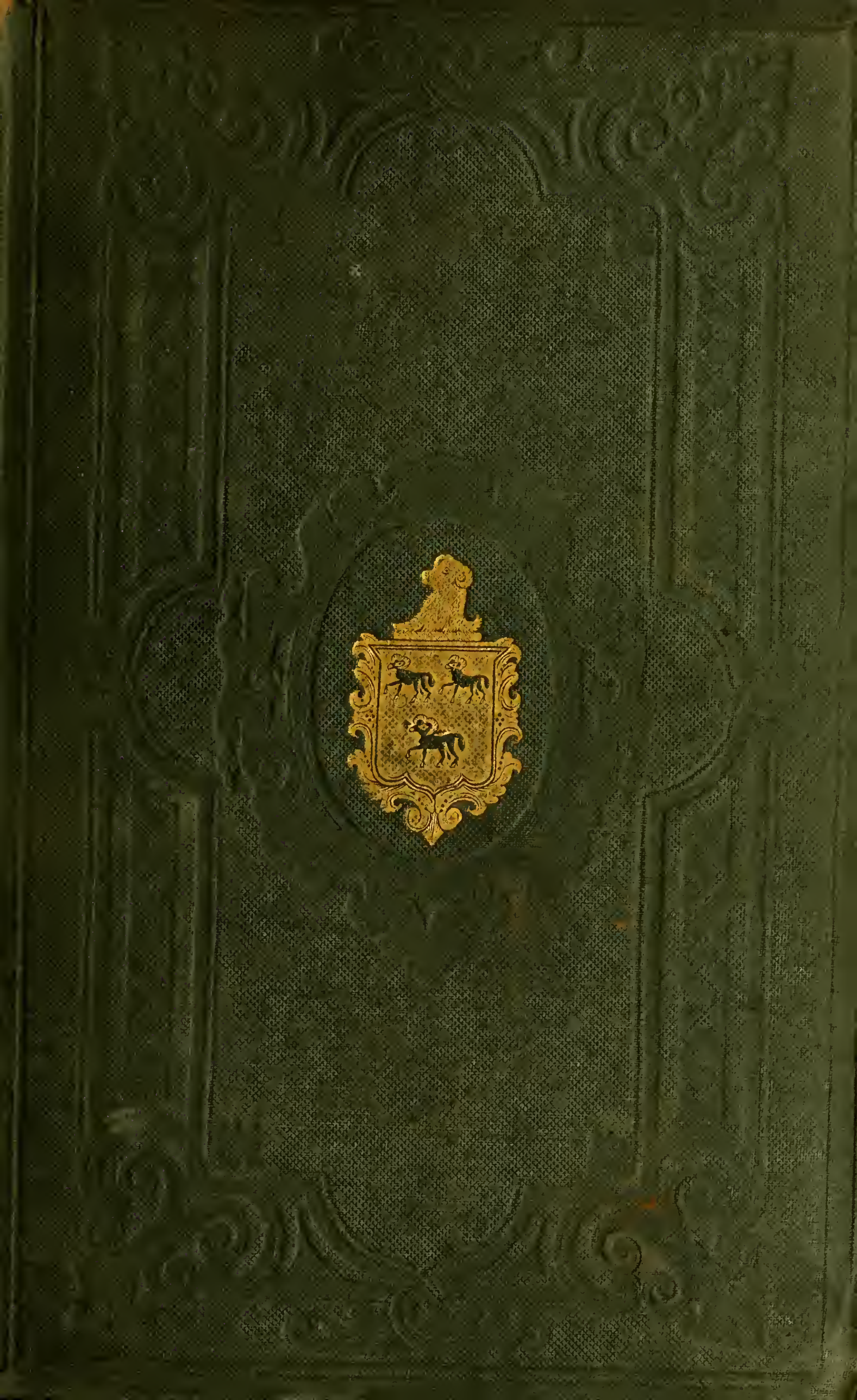

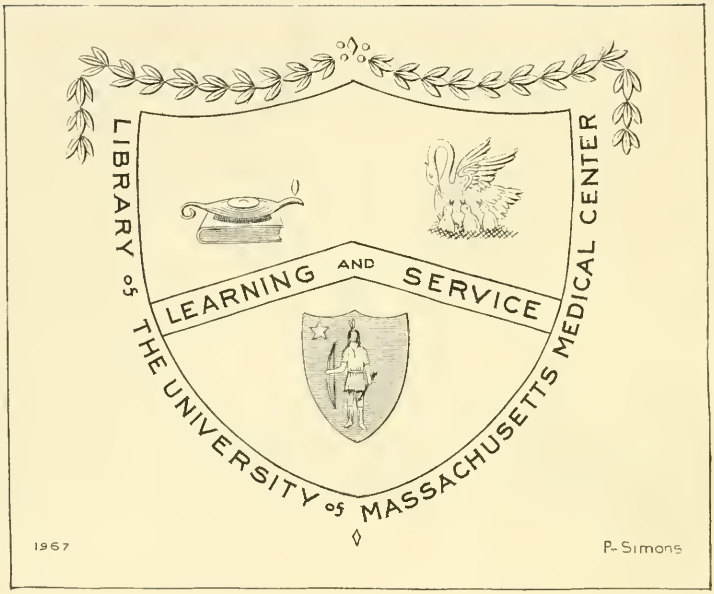
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A MANUAL

OF THE

NERVOUS DISEASES OF MAN.

BY

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DISEASES OF THE NERVOUS SYSTEM.

CLASS II.

THE DOCTRINE OF THE NEUROSES OF MOTILITY.

CHAPTER XV.

SPASM IN THE RANGE OF THE CARDIAC NERVES.

Experimental results.—The following are the most important results obtained by the experiments instituted recently to determine the relation between the movements of the heart and its nerves, and their irritation. The frog's heart, when removed from the body, continues its rhythmical movements for some time, not less than five, nor more than twelve, hours, at a temperature of from 12°—14°, (59°—64° F.)[1] The oxygen of the atmosphere, warmth, and blood serve as stimuli of the excised heart. The heart ceases to pulsate in an exhausted receiver; the pulsations of the heart may be alternately arrested and restored by alternately withdrawing and admitting air to the receiver of the air-pump.[2] The pulsations cease in hydrogen, and the heart collapses, while, in the vacuum, it remains distended.[3] Oxygen animates and accelerates the movements of the heart; so that they become universal, and almost permanent; warmth exerts a powerful influence. According to

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[1] Budge; Sympathischer Nerv mit besonderer Rücksicht auf die Herzbewegung, in Wagner's Handwörterbuch der Physiologie, vol. iii, p. 438.

[2] Tiedemann; Versuche über die Bewegung des Herzens unter dem Recipienten der Luftpumpe, in Müller's Archiv, &c., 1847, p. 490.

[3] J. Schulz; Diss. Inaug. de Motu Cordis Ranæ Temporariæ; Berol., 1850, p. 25.

Professor Ernst Heinrich Weber's observations, the auricle of a frog's heart, when removed from its ventricle fifty hours after the heart had been taken from the body, contracted $8\frac{2}{3}$ times in a minute; when the vessel in which it lay was warmed with the hand, its action was accelerated to $18\frac{1}{2}$ contractions in the minute.[1] When the temperature was reduced to 0° R. (32° F.), the contraction of the heart diminished more and more.[2] We also owe important and novel results to Professor Eduard Weber's experiments with the rotatory apparatus: 1. The demonstration of a tonic spasm of the heart; if the ventricle or the auricle is put in contact with the conducting wires for a few seconds, the muscular fibres contract gradually and persistently, so that the contracted portions are no longer implicated in the rhythmical movements. In this way the entire ventricle and auricle may be subjected to a spasmodic contraction, causing the movements to be altogether arrested. The heart continues in this condition for some time after the interruption of the current, and it is only after a considerable period, and then very gradually, that the tonic spasm disappears, and the rhythmical movements are restored. Professor Eduard Weber states that the local application of strychnine to the internal surface of the heart acts in a similar manner. To render the experiment successful, it is necessary to empty the heart of its blood, because strychnine causes coagulation of the blood, and is thus prevented from acting as it is precipitated, and because the coagulated blood prevents the contraction of the heart. 2. The manifestation of different effects produced by the electric stimulus, according to the point at which it is applied. If the current is directed to the bulb of the aorta of a frog, the contractions of the entire heart are rendered more forcible and frequent; if, on the other hand, the current be made to play upon the pulsating portion of the vena cava, the entire heart beats once more, and then becomes perfectly still, not in a state of contraction, but of complete relaxation, or else the beats become gradually slower, and then cease entirely. 3. Retardation and arrest of the movements of the heart from electric irritation of certain nerves and portions of the central organs; viz., the medulla oblongata and the corpora quadrigemina. The combined action of both vagi is necessary to exert an arresting influence upon the heart either of the frog or of mammals; irritation of only one vagus, or of the medulla oblongata, after division of either vagus, does not retard the action of the heart. During the arrest the heart becomes flat and relaxed, as it is during the diastole, and fills gradually with blood. Continued galvanising exhausts the vagus, and prevents it from exerting this power of arrest, so that in spite of prolonged galvanising, after a pause of longer or shorter duration, the heart again resumes its beats. This experiment will fail if the vagi are pulled or bruised during the preparation. The arresting influence which the brain exerts upon the heart by means of the vagi, accounts for the retardation of the pulse, which accompanies cerebral affections, and especially violent concussion of the brain; the physiological cause of which phenomenon we have hitherto been ignorant of.[1]

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[1] Eduard Weber: Ueber Muskelbewegung, in Wagner's Handwörterbuch, vol. iii, p. 35.

[2] Budge: loc. cit., p. 443.

In the first edition of this work (pp. 378-9) certain experiments were alluded to, by which it was attempted to show that irritation of the peripheral nerves, and the central organs, is capable of exciting and accelerating the contractions of the heart; we are not in a position at present to lay much stress upon these experiments, because the results they yielded were themselves too vague, and because other observers, such as E. Weber, have never succeeded in influencing the energies of the heart by isolated irritation of the sympathetic nerves, and because, without the application of any stimulus, the heart of recently-killed animals, in the majority of instances, moves irregularly, and even after a lengthened pause, resumes its movements without any external cause.

The recent experiments of Volkmann, which demonstrate the influence of injuries of definite portions of the heart upon the type of its movements, and upon the harmony of the succession and the frequency of the contractions, are full of interest. The excised frog's heart continues to pulsate for a considerable time, as if it had suffered no injury. The type may be at once changed, if the auricle be separated from the ventricle by a rapid stroke of the knife. Both parts generally continue to pulsate actively, but scarcely ever is there any correspondence between the frequency of the beats. If an incision be made vertically down to the middle of the separated ventricle, a complete contraction of the entire muscular mass is seen, but the portion lying to the left of the incision pulsates rather sooner than the other. When the incision is prolonged through three fourths of the length of the heart, the portion to the right follows the contraction of the other half at a still longer interval. When the division is carried down still further, several contractions occur on the left side before the right participates in them; the right side commences pulsating later, but with a different rhythm. After the two halves have been entirely separated, the left pulsates much more rapidly than the right.[1]

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[1] Eduard Weber; loc. cit., pp. 42—47.

In the spasmodic affections of the heart, which are generally known by the term of palpitation, we find increased acceleration and unrhythmical contractions occurring in paroxysms of which the patients are sensible. The impulse of the heart is sudden and abrupt, though rarely so forcible as to raise the hand or the ear when applied to the thorax. A bellows-murmur occasionally accompanies or masks the heart's sounds. The arterial pulse is generally small and oppressed. There is frequent dyspnœa; the paroxysm ceases suddenly or by degrees, and a free interval commences, during which the heart's action does not deviate from its normal condition.

Sometimes it is only the rhythm of the movements which is disturbed by the cramp. The patient experiences a rolling, or as it were a rising sensation in the heart, followed by an immediate arrest; it is manifested by the intermission of the cardiac and arterial pulse, upon which several unequal and irregular beats occur. It is inseparably associated with a feeling of anxiety. In other cases the contractions of the heart follow each other with abnormal frequency, without any deviation of the individual elements of the cardiac movements from their normal succession. The force of the muscular contraction may at the same time be either increased or diminished. In the latter case there is a continuous series of quick, frequent, weak, and fluttering beats, which correspond to a tremulous, shaking movement in the region of the heart. Finally, in some attacks, the force, frequency, and rhythm are disturbed at the same time; the patient is overpowered by a sense of anxiety, and thinks himself dying; and the oppressive feeling amounts to orthopnœa.

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[1] Volkmann; Nachweisung der Nervencentra von welchen die Bewegung der Lymphgefassherren ausgeht, in Müller's Archiv, &c., 1844, p. 427.

[A short notice of Volkmann's views is contained in an Analysis of his Dynamics of the Circulation, by the Editor, in the Brit. and For. Med.-Chir. Review, vol. viii, p. 98.]—Ed.

The duration of the paroxysms varies from a few seconds to half an hour, an hour, or more. They return frequently at regular or irregular intervals, or intermit for weeks and months.

A predisposition to the affection exists in youth and the middle periods of life; arthritis, especially if in a dormant state, and a hæmorrhoidal constitution, though less frequently than the former, predispose to it. A deficient and abnormal condition of the blood, the specific stimulus of the peripheral terminations of the sensory nerves of the heart, more frequently predisposes to spasms than the opposite condition. Hope's researches have not only determined the relations of anæmia to spasm of the heart, but have also fixed the diagnosis of this particular form. The impulse of the heart in these cases is abrupt and jerking; a general pulsation of the arteries occurs frequently, for which reason this variety of palpitation is more perceptible to the patient than any other. Auscultation shows the presence of a soft, gentle, bellows-murmur at the orifice of the aorta, accompanying the first sound of the heart. A bruit, or one rather of a humming character, may be heard in the larger venous and arterial trunks. The pulse is frequent and jerking, such as we also find it after considerable hæmorrhage.[1] Reflex influences often induce the affection, though attempts to accelerate the pulsations of the heart in frogs, by irritation of the skin and other organs, prove unsuccessful.[2] They proceed most frequently from the organs of digestion and the uterus; thus, hepatic and stomach affections, especially bilious accumulation and retention, and dyspepsia, act as exciting causes. Spasm of the heart is often induced by derangement of the catamenia, either in their development or after their regular establishment, especially when complicated with anæmia, as we see in chlorosis. In the male sex we also find that irritation of the genital organs, especially if accompanied by discharges, is apt to induce palpitation; it is often the consequence of masturbation. Centric causes are frequent. It is well known how often mental emotions, and particularly ungratified yearnings, whether of love or home sickness, (nostalgia,) induce palpitation; in describing psychical hyperæsthesia, I have dwelt upon the influence of the mind in promoting the affection. The hypochondriasis of students frequently produces palpitation; and an instance of its occurrence from the same cause, in advanced life, is presented to us in Peter Frank[1] himself, who while devoting especial attention to the subject of heart diseases in Pavia, while preparing his lectures, was attacked with such severe palpitations, accompanied by an intermittent pulse, that he felt assured that he was affected with an aneurism; the symptoms only ceased after the completion of his labours, and after he had enjoyed the relaxation and diversion of a journey.

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[1] Hope; A Treatise on Diseases of the Heart and the Great Vessels, 3d ed.; London, 1839, p. 509.

[2] Budge, loc. cit., p. 429.

The diagnosis of spasm of the heart from other conditions, which are associated with irregular movements of the organs, has been rendered much more certain and accurate by the introduction of auscultation and percussion than it used to be. The criteria that have been hitherto considered indicative of spasm, are—the free intervals; the relation borne by the attacks to exercise and rest (whilst palpitations accompanying organic diseases of the heart are increased by exercise, it diminishes those originating in spasm, which is rather likely to commence during rest, and especially after eating and in going to sleep); the combination with disturbances of other nervous functions; the relief obtained on improvement of the digestive organs. These indications, however, except the integrity of the heart during the interval, are unsafe; we obtain more satisfactory evidence from the normal extent of the heart, as shown by percussion, from the cessation of the bellows-murmur when the circulation is calmed, from the coexistence of a similar murmur in the large arteries, from its being limited to the aortic orifice, and from the absence of harsh, loud, morbid sounds at this and other parts of the heart. In a prognostic point of view we must not overlook the possibility of cardiac spasm after a long duration, passing into hypertrophy of the muscular tissue; it is a result that we find occurring in other muscles when similarly affected.

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[1] Jos. Frank; Prax. Medic. Univers. Præc., vol. ii, p. 373.

A spontaneous cure is effected most frequently by the appearance of an attack of arthritis; the technical cure is obtained by careful attention to the causes. Thus iron may be said to have a specific effect when the complaint is based upon anæmia; and as the colour of the cheek returns, we find the murmurs of the heart and arteries disappearing. The cure is promoted by nutritious diet, by a sojourn in the country, by exercise without fatigue. If there is plethora we must adopt an opposite line of procedure; blood may be taken by venesection, the vegetable acids, cremor tartari, &c., administered; the diet must be selected accordingly; and we must particularly attend to this point in individuals who, having been accustomed to a stimulating and nutritious dietary with an active mode of life, continue the former after they have abandoned the latter. When we have to deal with an arthritic, hæmorrhoidal, or dyspeptic constitution, we must adapt our treatment to the requirements of the case. With reference to the latter it is to be observed, that it probably will be found to have an atonic origin, and will therefore be aggravated by resolvents, while the preparations of iron and aloetics, (especially in the form of Stahl's aperient pills,[1]) will benefit the affection. In all these cases we must attend to the regulation of the bowels; the bodily treatment must be assisted by mental regimen. As palliative remedies we may occasionally find digitalis, hydrocyanic acid, colchium, and the mineral acids useful. Some writers have also spoken of arterial pulsations, which they affirm to be heterochronic with the beat of the heart. Thus Albers[2] quotes a few cases of melæna, in which violent pulsation of the abdominal aorta was not isochronous with the radial and cardiac pulse; and Morgagni[3] relates an instance of tumultuous pulsation in the epigastric

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[[1] The following is the formula for Stahl's Pills:

R. Ferri Pulverati, ℈ss;
Pulv. Aloës, ℈ij;
Ext. Colocynth., ℈j;
Mucil. Gum. Min., q. s.
Ut fiant pil. xl.]—Ed.

[2] Ueber Pulsationen im Unterleibe; Bremen, 1803, pp. 44—47.

[3] De Sedibus et Causis Morborum, Epist. xxxix, art. 18.

region which occurred with unequal force and at irregular intervals, being occasionally reduplicated, while the radial pulse was normal. But there was at the same time a large hard tumour which rose and fell, and the day after had again disappeared with the palpitation, after a vein had been opened. The same cause to which so often the isochronous pulsations in the abdomen are due, flatulent distension of the stomach, the duodenum and transverse colon, may, if the pressure be increased, temporarily compress the artery, and thus give rise to the want of harmony in the pulses. The physiological law that, with the exception of the heart and the commencement of the venæ cavæ, and pulmonary veins, no part of the vascular system is capable of spontaneous movements by muscular contraction, is too firmly established, that we should admit a spasm of the arteries upon the strength of a few pathological observations which are themselves not even properly supported.

CHAPTER XVI.

SPASM IN THE RANGE OF THE NERVES OF THE INTESTINAL TUBE.

Experimental results.—The latest experiments instituted in recently killed animals which yet retain their irritability, have afforded more satisfactory results, with regard to the intestinal canal, as they have in reference to the heart, than those formerly made upon living animals. By avoiding the irritant influence of the atmospheric air, and by employing the rotatory apparatus, we have also succeeded in obtaining definite effects upon the irritated nerves of the intestinal muscular fibres. The experiments have demonstrated that the commencement and termination of the moveable cylinder are under the control of spinal, and the intervening portions of the vagus and sympathetic nerves. If we wish to ascertain what nerves are destined for the movements of individual muscular groups, it is necessary to make our experiments upon their points of origin, as the nerve in its further course becomes mixed up with heterogeneous elements. Thus, the experiments of Volkmann have demonstrated that the contractions of the upper part of the pharynx depend upon the vagus. As each root was divided, a movement was perceptible, either in the soft palate, which occasionally rose, or sometimes was drawn forward, or in the pharynx, the upper part of which was at one time raised, at another contracted. Mayo and Müller were the first to observe that the glosso-pharyngeus exerted an influence on the muscles of the pharynx. Volkmann[1] states that it is only when the smaller root of this nerve, which was formerly overlooked, is irritated, that vivid contraction of the middle constrictor of the pharynx and of the stylo-pharyngeus ensue, whilst the larger root possesses no such influence. The movement of the œsophagus depends upon the vagus. If the roots of this nerve are irritated, powerful contractions ensue in its vertical and horizontal diameter, down to the cardia. The vagus is also proved, by the experiments of Eduard Weber,[1] to exert a decided influence upon the stomach, which was formerly disputed by Müller and others. On applying the conducting wires to the vagi of a dog, the stomach of the animal began to move energetically, as it never does upon mere atmospheric impression, without a direct irritation of the coats. Müller[2] was the first to discover that the peristaltic action is increased by irritating the cœliac ganglion. The objection raised that this was owing to an impression derived from the atmospheric air has been met by Weber, who repeated the experiment without opening the peritonæum, and by observing the intestines through it. On irritating the ganglionic plexuses surrounding the aorta by the rotatory apparatus, the small intestine and the colon, which had previously lain perfectly still, immediately on the current commencing to pass, began to move vividly; their action continued for a long time after the current had been interrupted. The same observer finds that the vagus also possesses an influence upon the movements of the intestinal canal: it is shown most manifestly in a fish, the tench (cyprinus tinca), in which the stomach and intestines have well-marked, transversely-striated muscles of animal life. They contract on the application of electric irritation to the vagi, as rapidly and violently in all their parts as the voluntary muscles do when their motor nerves are subjected to similar irritation. Among the central organs it is the medulla oblongata, which, when irritated by the galvanic current of the rotatory apparatus, most decidedly excites the movements of the stomach and intestinal canal.[3] Budge[4] obtained a similar result, though less marked, on applying the irritation to the cerebellum. The cerebrum and spinal cord exert no influence of the kind.

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[1] In Müller's Archiv, 1840, p. 493.

With exception of the two orifices, the movements of the intestinal tube possess the peristaltic character. There is a gradual progression of the contractions in undulations, that advance with a certain rhythm. The physiological conditions of the abnormal type of an alteration in the succession of contractions, with a retrograde movement of the undulations, have not as yet been determined.

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[1] Wagner's Handwörterbuch, &c., vol. iii, p. 50.

[2] Elements of Physiol., Dr. Baly's translation, vol. ii, p. 913.

[3] Weber; loc. cit., p. 49.

[4] Wagner's Handwörterbuch, vol. iii, p. 422.

SPASM OF THE PHARYNX AND ŒSOPHAGUS. DYSPHAGIA SPASTICA.

A sudden difficulty or impossibility of swallowing, accompanied by the sensation of a foreign body lying wedged in the pharynx, seizes the individual; and the symptom ceases as suddenly, commonly with a discharge of air that was retained. Dyspnœa, anxiety, and suffocative attacks are the usual concomitants. The muscles of the neck, the sterno-cleido-mastoid, and the trapezius are sometimes rigidly contracted. The spasm most frequently affects the lower portions of the pharynx or œsophagus. In the latter instance the substance is swallowed without difficulty, but is arrested in the vicinity of the cardia; a constringing pain is felt between the shoulders; there is a copious discharge of mucus and saliva from the mouth, with straining and regurgitation, until the paroxysm passes off, and the patient himself feels the morsel descending into the stomach.

Spasm of the pharynx induces a transitory contraction of the muscular fibres, or leaves a stricture, as an independent chronic affection of the muscular fibres, which has received the name, spasmodic stricture of the œsophagus, but has not hitherto been subjected to investigation by the scalpel and the microscope.

The middle period of life and the female sex are most liable to spasm of the pharynx. Arthritic and impetiginous constitutions afford a predisposition, whilst reflex influences are exerted by neighbouring and distant organs. Ulcerations of the larynx occasionally give rise to the complaint under consideration.[1] It is most frequently excited by irritation, proceeding from the uterus, and accompanies hysteria in the shape of globus hystericus; this term is, however, often applied to a neuralgic affection. Both the spinal cord and the cerebrum may be the seat of centric causes. Spasm of the pharynx occurs very frequently as one of the satellites of tetanus; and diseases of the cervical portion of the spinal cord and its osseous channel, are most frequently manifested by a spasmodic difficulty of deglutition, which with the progress of the disease is converted into a paralytic affection. In hydrophobia spasm of the pharynx is an uniform symptom, and is even excited by the mere mental impression. Friedrich Hoffmann,[1] who was the first to enter into a minute examination of convulsive affections of the œsophagus, relates a case in which the spasms were brought on by a mental impression. The influence exerted by emotions is well known. Epilepsy favours the development of œsophageal spasm.

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[1] Mayo; Outlines of Human Physiology: London, 1836, p. 280.

The safest means of distinguishing spasmodic from other varieties of dysphagia, and especially from those dependent upon contraction and tumefaction of the œsophagus, is afforded by the introduction of the probang, which should be provided with a large button. Even during the attack it may be passed with a little perseverance, and during the paroxysms the introduction meets with no impediment. We can place less reliance upon the periodic increase and diminution of the symptoms as a diagnostic sign, as organic degeneration, especially while it is being developed, is from time to time accompanied by spasmodic contraction.

The treatment of the affection is frequently very successful if we have regard to the cause. Joseph Frank[2] relates that a patient came to his father, who, in consequence of the suppression of habitual epistaxis, had for nine days been subject to spastic dysphagia. After the application of a few leeches to the nose, the power of deglutition was restored. Sir B. Brodie[3] restored a female, who, for three years, had been subject to dysphagia, so that she could not swallow anything solid, and liquids only with great difficulty, by removing internal hæmorrhoidal tumours, which from time to time had caused considerable hæmorrhage. If we are unable to ascertain or to remove the cause, it is necessary to direct our remedial agents against the peripheral sensory nerves or the central organ. The former indication is best fulfilled by the frequent introduction of a probang: Abercrombie[4] was consulted by a patient, who for more than a year, had been treated for stricture of the œsophagus: instead of the ordinary bougie, he recommended the introduction of an oval ball of silver attached to a wire; this had scarcely been done four or five times before every impediment had vanished. A relapse, which occurred after a year, was successfully treated by the same means. The cervical portion of the spinal cord may be attacked by derivatives and the abstraction of blood, especially by cupping. Among the internal remedies which act upon the central organs, belladonna (the extract dissolved in aqua laurocerasi) deserves the preference. Tode and Wichmann[1] recommend the exhibition of quassia. Patients of this description are always subject to constipation, yet, as Hoffmann correctly remarks, drastic purgatives should be avoided.

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[1] Opera Omnia, ed. Genevæ, vol. iii, p. 130.

[2] Prax. Med. Univ. Præc., vol. i, p. 144.

[3] Mayo; loc. cit., p. 281.

[4] Pathological and Practical Researches on Diseases of the Stomach, the Intestinal Canal, the Liver, &c.: Edin. 1828, p. 96.

ANTIPERISTALTIC SPASM OF THE ŒSOPHAGUS.

We have but recently learnt to understand the movements of the œsophagus in health. According to the observations of Magendie and Müller, rhythmical contractions of the lower portion of the œsophagus take place independently of the act of swallowing; they last about thirty seconds, and continue longer the fuller the stomach is. The contraction passes gradually into relaxation, which is again followed by contraction, so that the cardiac orifice is not always closed equally.[2] Eduard Weber[3] has discovered that in the œsophagus of the different classes of animals there is a difference in the character of the muscular fibres, and the manner in which they react to the electric stimulus differs accordingly. In rodentia he has invariably found muscular fibres of organic life, which present both longitudinal and transverse striæ; while, in birds, the muscular fibres are non-striated and organic; in the former the movement is entirely that of animal muscles, in the latter, that of organic muscles; in cats and dogs they present a mixed character, the fibre being partly animal and partly organic; the movements accordingly correspond to the double type. Modern research has demonstrated the important part which the œsophagus plays in vomiting. The experiments of Magendie, Legallois, Béclard, and the more recent investigations of Arnold,[1] have proved that the œsophagus performs antiperistaltic movements during vomiting, which even after it has been separated from the stomach are visible when tartar emetic is injected into the veins.

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[1] Ideen zur Diagnostik, vol. iii, p. 189.

[2] Müller's Elements of Physiol., Dr. Baly's translation, vol. i, p. 503.

[3] Loc. cit., p. 30.

The antiperistaltic spasm of the œsophagus, which takes place without any combined action of the abdominal muscles and the diaphragm, either manifests itself as retching, (*vomituritio, quasi dolores parturientes œsophagi,*) which may exist by itself unaccompanied by any discharge, with the peculiar sense of sickness (nausea), or as an act of regurgitation either of the contents of the œsophagus, as in dysphagia, or of the contents of the stomach, as occurs in eructation and rumination.

RUMINATIO, MERYCISMUS.[2]

After a shorter or longer interval subsequent to a meal, varying from a quarter of an hour to five or six hours, a part of the food rises into the pharynx; fluids do so more easily than solids, vegetable substances more so than animal matters; there is no nausea or retching, no offensive taste, and after the substances have been retained for a time in the mouth they are again swallowed, when another portion rises. This is repeated more or less frequently in a period of time varying from one to six hours. I have compared the cases reported by recent observers, and have not found that there is actual rumination like that of cloven-footed animals; the morsel that is thrown up is not again subjected to trituration by the teeth. The symptom is generally accompanied by derangement of the digestive organs, flatulency, constipation, voraciousness and gluttony, alternating with want of appetite. In the majority of instances it is involuntary; though in a case detailed by Peter Frank,[3] and in another by Blumenbach,[4] the commencement of the act of rumination, and in the latter even its arrest, were dependent upon the will. In some patients it is caused by pressure upon the pit of the stomach or concussions of the body. Eschke[5] relates the case of a deaf and dumb individual in the Berlin asylum, who bolted his food, and after half an hour had elapsed brought it back to the mouth by firmly compressing his stomach with both hands. Dr. Heiling[1] states that a Professor Westendorf, in Güstrow, was able to ruminate whenever he chose, but that he was also compelled to do so if he took any active exercise, for instance, if he rode in a carriage, after a meal. The rumination is said to cease if other diseases supervene. Percy mentions that a patient, who came under his own observation, did not continue to ruminate during a severe attack of gout, although he paid no particular attention to his diet.

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[1] Das Erbrechen, die Wirkung und Anwendung der Brechmittel; Stuttgart. 1840, p. 84.

[2] [From μηρυκίζω, to ruminate.]—Ed.

[3] De curandis hominum morbis, lib. v, p. 352.

[4] Handbuch der Vergleichenden Anatomie; Göttingen, 1805, p. 137.

[5] Hufeland's Journal des Pract. Heilkunde, 1810, Oct., p. 27.

Neither of the Franks, senior or junior, have met with the affection more than once in their long career. I have myself seen three cases; though it is probable that the symptom is often concealed. All the cases hitherto described, with one exception, occurred in the male sex, and commenced in early life. The causes are unknown; concomitant affections of the digestive organs, have been erroneously assumed to induce it. I am inclined to attribute some etiological influence to the will. Peter Frank is of opinion that in persons who suffer from eructations and are voracious, rumination is induced by a bad habit, the not unpleasant taste of the ruminated matter offering an encouragement to the repetition of the experiment.

In three ruminating individuals, all of the male sex, but whose history has not been further detailed, Arnold[2] has found a considerable dilatation at the entrance of the œsophagus into the stomach, limited above by a constriction, so as to form a genuine cardiac vestibule. The muscular layers of the stomach and œsophagus were strongly developed, and in two cases the stomach and œsophagus were larger and wider than usual. In the first instance the internal branch of the accessory of Willis was much larger than usual, so as almost to equal the external branch, a relation similar to what is found in ruminating animals. Numerous suggestions have been offered with regard to treatment, but they have not produced any beneficial results.

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[1] Ueber das Wiederkänen beim Menschen; Nürnberg, 1823, p. 13.

[2] Bemerkungen über den Bau des Gehirns und Rückenmarks, p. 211.

CHAPTER XVII.

SPASM OF THE STOMACH.

Of all parts of the intestinal tract, the stomach presents, in health, the lowest amount of movement, even when the abdominal cavity is opened in the living animal, and the irritation of the atmospheric air causes such energetic action in the intestines. The movements become more active under galvanic influence. If the conducting wires of the rotatory apparatus be passed vertically or longitudinally across the stomach, it may be seen distinctly to contract in the direction of these lines. This was most apparent in a dog, in whom the stomach was thus completely divided into separate compartments. After each contact of the wires a gradual constriction ensued. The transverse were invariably deeper than the longitudinal contractions, and the former were most marked in the vicinity of the pylorus.[1] During digestion contractions occur in the pylorus and the pyloric portion of the stomach, as Magendie has described in animals, and Beaumont in man.[2] It has not yet been determined whether the stomach is capable of independent spasmodic action. Budge's[3] investigations, which have thrown much light on the mechanism of vomiting, have shown that the adjoining portion of the intestine, the œsophagus and especially the abdominal muscles, are especially requisite to its production. This alone suffices to prove that vomiting results from the combined action of various nerves, and as it only occurs during expiration, it may be considered to be allied to the expiratory convulsions.

We must here advert to that vomiting which is caused by the irritation of peripheral nervous tracts, by reflex irritation, and by the affections of the central nervous organs. A few observations are on record which render it probable that organic degenerations of the nerves may be the cause of chronic vomiting. Joseph Frank narrates the case of a professor in Wilna, who for a few years suffered from anxiety, nausea, and vomiting during the morning, and was one day carried off by syncope coming on after very violent vomiting. On post-mortem examination, there was found hæmorrhage into the pericardium, a rupture in the left ventricle, and softening of the heart. The vagus of either side, from its entrance into the thorax, was surrounded by steatomatous tumours. A similar growth, of about the size of a hen's egg, occupied the right side of the neck. In a pregnant female, who for three months was subject to uncontrollable vomiting, which occurred thirty times a day, Lobstein[1] found the semilunar ganglia in a highly inflamed condition, which he has represented by a drawing. The stomach was in a healthy condition. Among the sources of reflex irritation, those proceeding from the sensory fibres of the vagus occupy the first rank. A special interest attaches to the auricular branch of the vagus, which when irritated, causes not only cough but vomiting. Pechlin[2] has met with a man in whom violent vomiting was excited by touching his external meatus; and Arnold relates the case of a girl who for a considerable period was affected with cough and expectoration, often vomited, and grew emaciated. On minutely examining her it appeared that there was a bean in each ear, which a considerable time previously she had introduced in play. Their extraction was accompanied by violent coughing, vomiting, and repeated sneezing. The attacks ceased at once, and the child recovered entirely.[3] The instances of vomiting from irritation of the respiratory tract of the vagus are too frequent to render any quotation of cases necessary.

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[1] Ed. Weber; loc. cit., p. 26.

[2] Müller's Elements of Physiol., Dr. Baly's transl., vol. i, p. 503.

[3] Die Lehre vom Erbrechen; Bonn, 1840.

Next in order we find that the hepatic, the renal, and the uterine nerves, the latter especially during the first months of pregnancy, are the conductors of the reflex stimuli of vomiting. Among the nerves of special sense, the olfactory, gustatory, and optic most frequently convey similar impressions.[4] Mechanical irritation, applied to those parts to which the sensitive fibres of the glosso-pharyngeus are distributed, titillation of the root of the tongue, or the velum palati, excites antiperistaltic movements, retching, and vomiting; whilst contact with the pharynx induces peristaltic movements of the œsophagus. Marshall Hall[1] quotes instances of patients who, in attempting to excite vomiting with the feather of a quill, caused an act of deglutition by approaching too near to the œsophagus, in consequence of which the feather was swallowed. Thus we see that irritation even of tissues in close proximity to one another produces very different phenomena of reflex action. Of the central organs, the spinal cord rarely bears an etiological relation to vomiting. Injuries and diseases of this portion of the nervous system are so uniformly followed by paralysis of the expiratory muscles, that that alone accounts for the rare occurrence of vomiting as a concomitant symptom. Among the great number of observations collected by Ollivier there are but very few instances, and they rather apply to the first stage of myelitis than to other spinal affections. On the other hand, the brain bears a close relation to vomiting. Even the stimulus of a mental impression suffices to excite it; and although instances of voluntary vomiting are rare, (Bichat possessed this faculty, and another instance is quoted by Richerand,[2]) the sight and remembrance of an offensive object give rise to it often enough. Concussions and injuries induce it frequently. Some writers attribute sea-sickness, with all its concomitant symptoms, to a concussion of the brain. This theory, however, is probably too exclusive, inasmuch as it makes no allowance for the influence which the rolling movements of the vessel must have upon the peripheral terminations of the nerves. The mere walking on the moving and gliding surface of the deck, as observed by V. Walther, in his ingenious notes of travel,[3] proves a source of vertigo and vomiting, to one not accustomed to these influences, if the first failing attempts be too long repeated. In the same way we are not justified in attributing the vomiting produced by other circular or rotatory movements of the body to the brain alone. Concussion of the brain is commonly accompanied by vomiting, and every sudden change in the tissue of the organ is liable to produce this effect. Thus Sir B. Brodie[1] observed vomiting to follow at once when depressed portions of the cranium were elevated. The syncope which is analogous to concussion of the brain, also frequently makes its *début* with vomiting. Among the morbid processes occurring in the brain, meningitis and hemicrania are most frequently accompanied by vomiting; but there is no disease of the brain with which it may not be associated, and Abercrombie[2] possesses the merit of having pointed out that there are organic affections of the brain, which at their commencement, and for a considerable period, are veiled by symptoms which indicate the stomach as the seat of disease. The results of the experiments above detailed, demonstrate that the vomiting in these cases, as well as the retardation and irregularity of the contractions of the heart which frequently accompany the former, can only originate in the transmission of the irritation from the brain to the medulla oblongata.

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[1] Prax. Med. Univ. Præc., vol. ii, p. 292.

[2] De Nervi Sympathici Humani Fabrica, usu et morbis; Paris, 1823, p. 148.

[3] Bemerkungen über den Bau des Gehirns, &c., p. 169.

[4] Observat. Phys. Med., l. ii, obs. 145.

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[1] Lectures on the Nervous System, &c., p. 23.

[2] Jos. Frank; loc. cit., p. 471.

[3] Journal der Chirurgie und Augenheilkunde von v. Gräfe und v. Walther, 1831, vol. xv, p. 183.

According to my experience the following are the characteristic symptoms which indicate that vomiting arises from a cerebral influence. 1. The influence of the position of the head; the vomiting is arrested in the horizontal, and recurs and is frequently repeated in the erect position. It is also easily induced by movements of the head, by swinging, shaking or stooping, or sudden rising. 2. The prevailing absence of premonitory nausea. 3. The peculiar character of the act of vomiting; the contents of the stomach are ejected without fatigue or retching, as the milk is rejected by babies at the breast. 4. The complication with other phenomena, the more frequent of which are pain in the head, constipation, and the irregularity of the cardiac and radial pulse which is increased during and subsequent to the act of vomiting. The duration of the vomiting is limited in the inflammatory affections of the brain, meningitis, encephalitis, and acute hydrocephalus, to the first stages of the disease; and the prevailing rule is, that as the paralytic and comatose symptoms increase, the vomiting remits and ceases.

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[1] Pathological and Surgical Observations relating to Injuries of the Brain, in Med. Chir. Trans., vol. xiv, p. 355.

[2] Pathological and Practical Researches on Diseases of the Brain, &c., 3d ed., p. 321.

In a therapeutic point of view, we must not overlook the relief frequently afforded in cerebral affections by vomiting. Surgical notabilities (Dessault, Richter,) upon the strength of this observation have advised the exhibition of tartrate of antimony in concussions and injuries of the brain; and my renowned friend Heim once assured me that, during the long course of his practical career, he had not obtained such satisfactory results in the treatment of apoplectic conditions from any remedy as emetics afforded. There can be no doubt that the fear of their employment in these states has been exaggerated.

CHAPTER XVIII.

INTESTINAL SPASMS.

We may distinguish two varieties of spasms of the intestines —1, one that advances by undulations in a peristaltic or an antiperistaltic direction; 2, the other, in which the affected portion of intestine is constricted in a ring. Both occur separately, or associated with one another, and are accompanied by pain, and various other sensations.

Peristaltic Spasm, Colic.—From whatever part of the intestinal canal the spasm may proceed, it is only the last rapid terminal undulations which are manifested by a frequent desire to evacuate the rectum, and a distressing sense of weight and pressure at the fundament, which ceases after the evacuation, permits of a short rest, and then again returns. The less the discharge the more forcible and more painful the straining, to which a distinct term *tenesmus* has been applied. The strongest proof of the intensity with which, occasionally, the peristaltic spasm of the intestines may take place, is given by the occurrence of prolapsus of all the coats of the rectum; as well as by the analogous condition of intussusception of the intestines, which is only to be distinguished from the former by the circumstances that the inverted intestine is surrounded by a non-inverted portion, instead of being free, as in the latter case.[1] Thus we are able to produce intussusceptions by applying irritants to the intestines. Haller[2] says that he learnt by experiments upon frogs, that it was produced in this manner. If to any point of the intestine a poison is applied, it is constricted, and soon the adjoining portion will be found to ascend, and to surround the constricted portion.

Among the etiological relations of intestinal spasm, those depending upon an abnormal excitement of the motor nerves, are the subject for our present consideration; for those move-

[1] Meckel; Handbuch der Pathol. Anat., vol. ii, p. 325.

[2] Opuscula Pathologica; Lausanne, 1768, p. 66.

ments which result from irritation of the coats of the intestines in consequence of the altered condition of their contents, the secretions, or their tissues, are but one link in the chains of other morbid processes, which are foreign to our subject; we allude to dysentery, diarrhœa, carcinoma of the colon and rectum. If we first look to the reflex irritation, we find that it occurs frequently, and, if seated in the sacral and lower lumbar nerves, induces not only intestinal, but also vesical and uterine, pains. Vesical calculus, irritation of the neck of the bladder, and of the uterus, act in this manner. Valentin[1] has made the highly-interesting observation, that even irritation of the fifth nerve, at the base of the skull, invariably gives rise to peristaltic movements of the small intestine; and especially of the duodenum and the upper portion of the jejunum. We possess but very few satisfactory pathological facts in evidence of the influence exerted, by the affections of the spinal cord and brain, upon spasms of the intestines. The influence of the emotions, and especially of fright, in increasing the movements of the intestines, is well known; in this symptom, however, the altered state of the secretion is not to be overlooked. The specific action of some medicinal substances upon the contractions of the rectum, is only effected by the agency of the spinal cord.

Spasmodic Stricture of the Intestine.—Experiments instituted by older writers, and more especially by Haller,[2] proved that irritation of the inner lining of the intestines gave rise to annular contractions, looking as if a thread were tied round the intestine. Henle, very recently, has found that the effect corresponds closely to the amount of irritation applied. If a slight stimulus be used, e. g., gently touching or scratching the external or internal surface of the intestine, or the application of muriatic acid, a trifling annular contraction ensues, which advances to a greater or less distance by peristaltic action. If the irritation is increased, a stricture remains at the part affected, even though peristaltic action ensues in the vicinity. But if the intestine is violently pinched, lacerated, or punctured, a violent contraction, annular or confined to one side, takes place, which may obliterate the passage through the intestines, which does not advance, and continues long after the irritation has ceased.[1] Such constrictions are often found in post-mortem examinations at various parts of the intestine; and may arise after death, and be the effect of the rigor mortis. But there can be no doubt that spasmodic intestinal strictures may occur, and persist for a long time during life; either idiopathically, or associated with other affections. Of the former, Mayo[2] communicates a remarkable instance; it occurred in a medical man who, during twenty years, had only twice, for a brief period, been free from his troubles; once while using warm water enemata, the other time while taking white mustard. During a series of years his excrements were no larger than a horse bean when hard, or, if soft, of the length of his little finger. At times, only an ordinary urethral bougie could be introduced into the rectum, at others the contraction was seated so high up in the rectum that a bougie of three feet in length could scarcely reach it. His sufferings reached the highest pitch; and at last the patient resolved to omit the use of all medicines and bougies, and to persevere in a strict diet, avoiding all irritating articles of food, and to leave the intestines to themselves. At first he, from time to time, came to their aid with water enemata, on account of a troublesome sense of fulness in the intestines and in the head. After two years he was entirely freed from his complaint. Tanquerel des Planches[3] states that the rectum and sphincter ani are in a state of rigid contraction during the violent attacks of painters' colic.

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[1] De Funct. Nervor. Cerebr., p. 63.

[2] Haller; Opera minora, vol. i, p. 395, Exp. 377-378.

Antiperistaltic Spasm of the Intestine—Ileus.—When the abdomen of animals is opened, the movement of the intestines is never merely peristaltic; at some points an antiperistaltic movement is always visible, as Haller has already observed, when he says: "the most complete peristaltic movement is always of a compound character, as neither the gases nor the food are ever seen to advance far without some retrograde movement."[4]

When the stimulus is stronger than that of atmospheric air, the receding undulations of the movement become stronger,

[1] Henle; Patholog. Untersuchungen, p. 93.

[2] Outlines of Human Pathology; London, 1836, p. 351.

[3] Traité des Maladies de Plomb.; Paris, 1839, vol. i, p. 209.

[4] Elementa Physiol. Corp. Human., vol. vii, p. 90.

and more permanent, and acquire the upper hand. The stomach and œsophagus participate, and the contents of the intestines are evacuated in an abnormal direction. At the same time violent contractions of the abdominal muscles take place, accompanied by phenomena in the sensory sphere, such as are peculiar to the sympathetic; for there is not only pain varying in degree and extent, but also a sense of fainting, and of approaching annihilation, which are manifested equally in the sunken powers, the hollow features, the low temperature, and the small, unequal, quick pulse.

The antiperistaltic spasm is apt to supervene upon any impediment presenting itself to the permeability of the intestine, whether resulting from spasmodic action (stricture, intussusception), or an inflammatory or mechanical difficulty; these circumstances impart distinct features to the individual case, which are fully and minutely detailed in Naumann's 'Handbuch der medicinischen Klinik,'[1] which we would recommend the reader to consult. It has not as yet been determined, either by experiments, or by pathological observations, whether ileus may originate in irritation, or diseases of the central organs of the nervous system.

There are few spasmodic affections in which the therapeutic treatment, that corresponds to our theoretic view of the disease, is so sure of a favorable issue in the uncomplicated cases, as in ileus. Narcotisation of the intestine by opium, either given by itself, or alternated with purgatives, and by tobacco enemata (from 15 to 20 grains for an infusion, with from four to six ounces of water,) are recommended by men of the most extensive experience.[2] The sudden remission of the spasmodic contraction is promoted by the employment of the warm bath and of venesection, which may be repeated as occasion requires, and which in conjunction with local abstraction of blood, anticipates the supervention of inflammation. Upon the same grounds, and in order to limit the tympanitic distension of the portion of intestine seated above the contraction, the local application of cold is advisable. We may also advert to the endermic application of purgatives; I am acquainted with a case, in which ileus had continued for eighteen days, and was removed by strewing six grains of extract of aloes upon a blistered surface on the pit of the stomach.

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[1] Vol. iv, p. 755—820.

[2] See—Abercrombie; Pathological and Practical Researches on Diseases of the Stomach, &c.; Edinb., 1828, p. 144.

In a like manner as the upper orifice of the intestinal tube, the pharynx, is provided with muscles, the lower orifice is also guarded by a similar apparatus; both being under the control of the spinal system, the consequence is, that those parts do not contract according to the peristaltic type, but rapidly and instantaneously, on the application of a stimulus.

Spasm of the anal muscles.—Hitherto, writers have confined their observations to cramp of the sphincter muscle, although the levator ani, and even the transversi perinæi, may undoubtedly be the seat of convulsive affections. In anal spasm, the individual is seized with a pain confined to the orifice of the anus, similar in intensity to that attacking the calves of the legs; the sphincter is rigidly contracted, which the patient distinctly feels, and it impedes or prevents the introduction of a finger for the purposes of exploration. Such attacks generally come on suddenly, and cease as quickly after a short duration, or they disappear gradually, after having given rise to great inconvenience for several days. Besides this transitory affection, there is another contraction of the sphincter, which was first accurately described by Boyer.[1] The following are the pathognomonic symptoms of the complaint: contraction of the sphincter, closure of the anus, so as to render the introduction of the finger or of a bougie, very difficult, intense pain at the margin of the anus, which is increased to the utmost during and after defecation. Constipation, absence of a discharge from the anus, derangement of the general health when the disease has lasted for some time, great irritability and ill temper.

Anal spasm is, at times, induced by reflex irritation proceeding from the rectum and adjoining organs. Thus Boyer has often observed contraction accompanying a fissure of the anus, which becomes visible on examination, and excites violent pain when touched. In several patients hemorrhoidal tumours had preceded, which in some had been extirpated. Infancy and youth are exempt from the affection. The female sex appears to be more subject to it than the male. The disease is not generally correctly understood, and local and general treatment on the assumption of stricture of the rectum, hemorrhoids and the like can only aggravate the evil. Purgatives and enemata at first afford relief, but after a time they become quite inoperative, and fail of giving even momentary relief. Narcotic hip baths and unguents, especially those containing belladonna,[1] have in some instances proved beneficial. Generally speaking, the most permanent good results are obtained by dividing the sphincter ani; this is best done on both sides, and is advisable both in the permanent as in the transitory form of spasmodic contraction.

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[1] Remarques et Observations sur quelques Maladies de l'Anus, in Journal complém. du Dictionnaire des Sciences Médicales; Paris, 1818, vol. ii, p. 24.

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[1] Boyer's Prescription is: R. Axung. Porc., Succi Semperviv. tect., Succ. Belladonn., Ol. Amygd. Dulc., āā ℥ij.

CHAPTER XIX.

SPASM IN THE RANGE OF THE NERVES SUPPLYING THE MUSCLES OF MICTURITION.

Our knowledge of the movements of this system of muscles in health, has advanced but little, and demands further investigations. Haller[1] denied that the ureters possessed the faculty of contracting on the application of stimuli. Weber found that he could, by applying galvanic stimuli to the ureters of a dog, produce at will distinct transverse contractions, which allowed of no doubt as to the existence of organic muscular fibres in these parts. This peristaltic action undoubtedly exists in morbid conditions as in the descent of renal calculi, and it is manifested by pain. The urinary bladder of a rabbit was seen to contract rapidly and completely under the influence of the rotatory apparatus, and to discharge its contents. Weber saw a vivid contraction occur at the point of contact with the two ends of the conducting wires, in the half-filled bladder of a cat, which rapidly extended over a large portion of the organ, and then gradually disappeared. After a short time, without repeating the irritation, a similar movement again commenced at the point first irritated, and was repeated several times at given intervals. No independent movements have hitherto been observed in the ureter, a negative fact which is in unison with the prevailing view as to the absence of muscular fibres in the part.[2] The same want of agreement as to the movements of the muscular apparatus of micturition generally, also exists, in reference to the antagonism between the muscular fibres of the bladder and of the sphincter. The layer of muscular fibres placed at the lowest portion of the urinary bladder, is still looked upon as the sole sphincter muscle of the bladder; we owe our knowledge of this part to

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[1] Opera minora, vol. i, p. 383.

[2] See—Shaw, on the Membranous part of the Urethra, in Med.-Chir. Transact., vol. x, p. 339.

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Sir C. Bell, who was the first to describe it minutely in his treatise on the diseases of the urethra, vesica urinaria, prostata and rectum (London, 1820,) in which we find numerous valuable physiological disquisitions. But some of the older anatomists, (Winslow, Santorini,) and among the modern, Sir C. Bell[1] and Guthrie[2] have attributed to the muscles lying at the posterior portion of the urethra, an essential part in the functions of closing the bladder; among these the constrictor isthmi urethralis, first discovered by Wilson, and accurately described by Guthrie and Müller, is particularly important. We also find, that as in the anus, the antagonism between the different muscles is manifested by their structure; for the red muscular fasciculi surrounding the membranous portion of the urethra contain transverse striæ, while the fibres of the urinary bladder, exhibiting no striæ, correspond with the muscular fibres of the intestine and uterus. The difference is not confined to the structure of the muscles, but is also exhibited in the nerves, for which the muscular layer of the bladder is supplied with sympathetic nerves, these muscles derive their nerves from the cerebro-spinal system.

In morbid conditions the antagonism continues; spasm, for instance, may attack the muscles of the bladder only (detrusor urinæ), or it is abolished; the occluding muscles may also be involved, and the consequence will be the combined symptoms of ischuria and dysuria.

Spasm of the Bladder—Dysuria Spastica.—There is a frequent and violent desire to evacuate the contents of the cavity, with a painful sense of pressure in the vicinity of the outlet of the bladder, resembling the symptoms of colic. The less urine is discharged the more the desire to micturate, and the pain increases, and these symptoms extend to the neighbouring muscles of the anus and perinæum, whilst the abdominal muscles are not affected. The passage of the sound through the urethra is unimpeded in uncomplicated cases. Painful sensations in the sacrum and thighs occur frequently. It is characteristic that there are longer or shorter free intervals.

Spasm of the Sphincters—Ischuria Spastica.—There is generally a sudden retention of urine, accompanied by a violent constringing pain at the lower vesical region. The action of the abdominal muscles is increased, in order to surmount the difficulty. The muscles of the anus are not unfrequently involved in the spasm. If a sound is introduced, it meets with an impediment at the membranous portion of the urethra. The symptoms of ischuria supervene, the bladder becomes distended, there is great anxiety, restlessness, cold sweat, tympanitic distension and hiccup. All at once the sluices are opened, the urine flows, and the patient experiences a most grateful sensation of well being. When the expellent muscular fibres are at the same time affected with spasm, we find the patient suffering from a forcing desire to micturate, and the paroxysm becomes of the most agonising character.

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[1] Loc. cit., p. 86.

[2] On the Anatomy and Diseases of the Neck of the Bladder and of the Urethra; London, 1834, p. 16.

Reflex influences are frequent *causes* of vesical spasm; it rarely results from spinal or cerebral affections. The former are often induced by the sensory nerves of the bladder and urethra. Bell[1] has shown that the most sensitive point of the bladder is in the vicinity of the orifices of the ureters, at which part we find the inner membrane more vascular than elsewhere. From this point the action of the vesical muscles, which in health possess an antagonistic character, is excited with as much certainty as the play of the respiratory muscles is induced by irritation of the glottis; we either find the bladder contract while the sphincters are relaxed, or conversely the sphincters contract and the detrusor urinæ is relaxed. Irksome and painful as the introduction of the catheter may be, the patient does not experience a desire to micturate, until the instrument is brought into contact with the point just mentioned, and it produces this effect even when the bladder is perfectly void. So it happens that calculus vesicæ, though it may give rise to pain at any point, only induces the agonising ischuria when the stone touches the neck of the bladder, and ceases at once when the calculus is removed by a sound or by changing the position of the body, as in inverting the head and raising the feet. Every other kind of vesical irritation acts in the same way, whether caused by an arthritic, rheumatic, or inflammatory affection, or by an altered and acrid condition of the urine. On the other hand, irritation of the urethra, and especially of its middle and posterior portion, induces a contraction of the sphincters. The introduction of a thin sound to a certain depth not unfrequently gives rise to spasm, and we may thus explain the spasm of the muscles surrounding the membranous portion, which from time to time supervenes upon strictures of the urethra; for the contraction itself is not of a spasmodic character, as one might be induced to assume, from the term spasmodic stricture being used in contra-distinction of permanent stricture.[1] The reflex irritation which gives rise to spasm of the bladder may also proceed from other organs. Thus Brodie, in his valuable work (p. 303), has directed attention to the fact, that in diseases of the kidneys (lithiasis, nephritis, suppuration) the symptoms often indicate the bladder only, and give rise to violent vesical pains. The intestinal canal, and especially the rectum (piles, particularly after the application of the ligature), and the uterus are still more frequently the sources of reflex irritation. Strangury and ischuria are frequently associated with hysteria. Even dentition is not unfrequently a cause of the complaint. Some parts of the cutaneous covering appear to exert a similar influence. Cold and wet applied to the feet, and especially to the soles, often give rise to sudden spasm of the bladder. As regards the central organs we find that the commencement of inflammatory affections of the spinal cord is at times accompanied by spasmodic strangury, which also occurs in cerebral affections as a forerunner of apoplectic, or a sequel of epileptic attacks, and overwhelming mental emotions, such as fright and great alarm, and especially the fear of death. A judge of the criminal courts related to me that a man, convicted of highway robbery and murder, who was executed some years ago in the town, before mounting the scaffold, prayed to be allowed to gratify the urgent desire to micturate. Even certain mental impressions are capable of inducing a greater inclination to frequent contractions of the vesical muscles; as in other instances they affect the muscular fibres of the rectum. We occasionally meet with hypochondriacal patients, who think of nothing else but the state of their evacuations; I have had a gentleman of this description under my care, who always remained in the vicinity of his house, when he took a walk, in order to be able at once to follow the call of nature. There was another, who had heard that the formation of calculus could be prevented by frequent micturition; after the impression had ceased to harass him, he was still often reminded of it by an annoying sense of strangury.

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[1] Loc. cit., p. 11.

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[1] Consult—Bell, l.c., p. 88; Guthrie, l.c., p. 86; and Brodie, Lectures on the Diseases of the Urinary Organs; London, 1832, p. 6.

The prognosis of the complaint must depend upon the causes, the accompanying affections, and the consequences of the spasm. The latter are either manifested at once, as, for instance, by the imminence of uræmia, or they are developed gradually, as in the case of hypertrophy and contraction of the muscular tissue. Nor are the vesical muscular fibres alone subject to these alterations; it is probable that the muscles surrounding the membranous portion of the urethra, may, under the influence of long-continued irritation, enter into a permanent contraction, which may have more to do with the painful attacks than the stricture itself.

In our *treatment* the most important indication consists in removing the source of reflex irritation. If it resides in the bladder, we must select our remedies according to the character of the irritation; if there be inflammatory action, antiphlogistic treatment, in rheumatic cases camphor and warm baths are indicated; we must not overlook the state of the urine as an irritant in exalted irritability of the parts, and in such cases we may suitably employ the injection of tepid water into the bladder, as recommended by Bell,[1] as diluents taken by the mouth do not suffice in these cases. It will also be useful in certain instances to avail ourselves of the fact regarding the most sensitive point of the bladder, as spoken of above; thus the spasmodic contractions of the organ are relieved by the surgical dislocation of the calculus, or by change of position; which may be tried in vesical cramp arising from other causes. The habitual nocturnal enuresis which so often occurs in children is of a spastic character, and dependent upon irritation of the bladder, as first shown by Peter Frank,[2] and of the intestine. The erroneous assumption of debility and paralysis, leads to the useless employment of tonics; by merely changing the position of the child, and instead of allowing it to lie on its back, placing it on its stomach or side, the urine accumulated in the bladder will be more uniformly diffused, and the impression upon the most sensitive point be diminished. If the cause of reflex irritation resides in the urethra, by which the sphincters are rendered most liable to spasm, we must have recourse to surgical interference, especially with a view to the proper treatment of stricture. In these cases the advantage of thick bougies or of catheters, is manifested if there is a temporary retention of urine. Whereas the introduction of a narrow sound increases the spasm, it is relieved by the compression exerted upon the irritated sensory nerves, from which the reflex action proceeds, by a thick sound; in the same manner as the probang with a large button, relieves spasmodic dysphagia. Besides the urinary apparatus, the intestinal canal and the uterus are deserving of attention in a therapeutic point of view, as foci of reflex irritation; there are numerous instances on record, of a permanent cure being effected by purgative treatment, after the bougies and cauterisation had for a series of years been employed in vain, and even to the detriment of the patient.

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[1] Loc. cit., p. 22.

[2] De curandis hominum morbis epitome, vol. v, de profluviis, pl. i, p. 72.

Palliative relief may be obtained by warm hip-baths, the local abstraction of blood, fomentations of the perinæum, anodyne enemata, and clysters with infusion of tobacco, and by the internal administration of opium and camphor.

CHAPTER XX.

SPASM IN THE RANGE OF THE NERVES SUPPLYING THE SEXUAL MUSCLES.

Besides the differences resulting from the differences of sex, we find that in the same sex, the female, these forms of cramp vary, according as the organism is engaged simply in the preservation of the individual or in the propagation of the species.

In animals we may observe a peristaltic action of the Fallopian tubes and the uterus, both in the impregnated and the unimpregnated condition; Edward Weber states that the uterus of a pregnant bitch very much resembles the small intestines. Like the latter, the uterus, on opening the abdominal cavity and exposure to the influence of the air, exhibits vivid peristaltic movements which take place in constantly recurring undulations that pass along the cornua from the tubes to the azygos portion of the uterus. After the movements had ceased, the organ still contracted at all points touched by the wires, and the resulting contractions continued long after the contact had ceased. Weber[1] has also observed visible contractions in the unimpregnated uterus of a rabbit. On applying galvanic action to recently killed, impregnated rabits, Reil found that such vivid, vermicular movements were induced between the two poles of the uterus, as he had never seen in the intestines; the young were expelled in less than half a minute; in these experiments the negative pole was applied to the orifice, the positive pole to one of the cornua of the uterus.[2] The discovery of Budge,[3] which has been confirmed by Valentin,[4] that irritation of the cerebellum exerts an influence upon the movements of the cornua uteri and the tubes, is very interesting, as well as the observation made by the former,[1] that movements are induced in the uterine horns by irritation of the clitoris, in the same way as movements of the fundus vesicæ result from irritation of the orifice of the urethra.

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[1] Loc. cit., p. 27.

[2] Ueber das Polarische Auseinanderweichen der ursprünglichen Naturkräfte in der Gebärmutter zur Zeit der Schwangerschaft und deren Umtauschung zur Zeit der Geburt, in Reil's und Autenrieth's Archiv für die Physiologie, vol. vii, p. 434.

[3] Untersuchungen über das Nervensystem, No. II, p. 82.

[4] Repertorium, vol. vi, p. 327.

The history of the normal contraction of the uterus must assist us in forming our opinion of the spasmodic action of the organ. The muscular tissue of the uterus has been undeniably demonstrated by the microscope, and exhibits the same progressive development as seen in the embryo; but although no other organic muscle is so accessible to direct and indirect exploration, and although since the suggestive investigations of Reil, which must always remain an imperishable monument of ingenious conception and able exposition, our knowledge of the uterine movements during the act of parturition, has been much advanced, especially by Wigand, it is undeniable that certain deficiencies still continue to exist. The latter writer[2] has even raised doubts as to the contractions assumed to take place at the fundus uteri, for his observations lead him to assert that the contractions, in each labour pain, commence at the os uteri, and are propagated to the fundus. The antagonistic activity is apt to be too exclusively referred to the upper and lower segment of the uterus alone; but the abdominal and perinæal muscles also stand in an antagonistic relation in labour pains, and even the sphincters of the anus and bladder are involved.

Spasmodic labour pains.—Convulsive uterine pains, like the spasms of the bladder, occur in two forms; there is either an increase of the expulsive function without any resistance of the sphincters, or there are concurrent contractions both at the fundus and the cervix, in the abdominal and perinæal muscles; the parturient effort is combined with a counteracting force. Both varieties have one feature in common, which consists in an alteration of the normal pains, both as to time and locality.

In the first form, the pains from the commencement occur

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[1] Loc. cit., No. I, p. 163.

[2] Die Geburt des Menschen in Physiologischer, Diätetischer und Pathologisch-therapeutischer Beziehung, 2d ed.: Berlin, 1839, vol. ii, p. 140.

with the greatest violence, following each other with very short intervals, or without making any pauses; they dilate the passages rapidly and forcibly, and expel the infant suddenly and violently. The pains are considerable, and the fundus of the uterus may be felt externally to be in a state of constant tension. The movements of the child are not to be felt. The second form, for a detailed account of which the reader is referred to Kilian's[1] treatise, 'Die Krampfwehen,' creates an impediment to the process of parturition, accompanied by forcing efforts. The cyclical order of the pains is abnormal; a pain suddenly attains its climax, which it maintains for a lengthened period, and then sinks with the same rapidity. The contraction is partial or unequal; or if general, the fundus does not possess the necessary power to overcome the resistance of the uterine orifice; and the latter not being conquered, is as much contracted as the former; it is so high up that it is difficult to reach it in exploration, at the same time it is distorted or elliptic. The position and form of the uterus is altered; it is drawn more or less to one side, so as to resemble a large hourglass, either in an horizontal or an erect position.[2] The degree of tension and the direction of the membranes are also changed. The contractions (die abspringenden Wehen) are not confined to the uterus; they affect the adjoining sphincters, and even other muscles, e.g. those of the thigh. The uterus presents increased sensibility, which manifests itself on mere external touch, but still more on touching the os uteri. The labour pain is frequently of extreme intensity, and takes an unusual course, passing beyond the pelvis, and affecting the course of the sciatic nerve. It attains its highest point in those cases in which the spasm induces a stricture of the uterus. Wigand[3] was the first to speak of it as a tetanic affection, and Kilian has described it as residing in the lower segment of the uterus, at the internal orifice, where a separate circular layer of muscular fibres is said to exist. According to the observation of my friend, Dr. C. Mayer, it is the external orifice of the uterus which is most frequently subject to spasmodic contraction. The contraction occurs very rapidly, and is accompanied by a pain suddenly mounting to the highest point, and causing boring and racking sensations in the sacrum and bladder, with a sense of violent bearing down, as if the child were on the point of tumbling out. Kilian also looks upon the rapid formation of a tumour on the presenting portion of the child, which is immovable even during the most violent forcing down, as a characteristic feature. In spasmodic labour pains the affection easily and frequently passes from the nerves of the uterus and the adjoining parts, to other nervous tracts. Vomiting, pain at the præcordia, eructations, sobbing and respiratory spasms, often supervene; the central organs of the nervous system are not unfrequently implicated, and we find a change in the state of the patient's spirits; there is delirium, syncope, collapse, vertigo, cephalalgia, unconsciousness, sopor, or universal convulsions, symptoms which are at times accompanied by a remission or cessation of the uterine spasm.

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[1] Die Krampfwehen, ein Beitrag zur Lehre von den Dynamischen Geburtsstörungen, in: Organon für die gesammte Heilkunde, vol. i, pp. 167—199.

[2] Wigand; loc. cit., p. 158.

[3] Loc. cit., p. 159.

The causes of the supervention of spasmodic labour pains are generally reflex influences proceeding from the uterus itself or its contents; these spasms generally occur after parturition, rarely in miscarriages or premature labour, and most frequently in primiparæ, or such as have borne many children. Increased sensibility of the uterus, caused by a rheumatic, inflammatory, or gastric irritant, and exalted by unnecessary and rude manipulations, is often at the bottom of the occurrence; not unfrequently it is due to an irregular position of the child, premature discharge of the liquor amnii, dragging at the umbilical cord, or retained coagula, which may give the after-pains a convulsive character. It has not as yet been determined whether spasm of the uterus may be induced by reflex irritation proceeding from adjoining organs, the rectum or the bladder. Among the centric causes emotions are the most frequent.

In our prognosis we have to consider two individuals, the mother and the child; generally speaking, spasmodic labour pains are of serious import to both; in extreme cases, the stricture may encircle the neck of the child if the head presents and is low down, or compress the liver and then produce fatal results; Kilian[1] reports a case in which the compression produced a rupture of the liver; the mother's life is perilled by the exhaustion of the vital powers, or by the occurrence of rupture and inflammation of the uterus. Excepting the stricture, there is nothing that enhances the danger of the affection more than the state of the cerebral organs. In the variety first described, which Wigand terms Ueberstürzung der Gebärmutter (summerset of the uterus) pernicious hæmorrhages are to be most feared.

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[1] Loc. cit., p. 177.

The correct diagnosis of spasm of the uterus is of extreme importance as regards the *treatment* of the parturient female; it is the best preventive of the frequent and injurious operative interference which is adopted on the supposition of mechanical impediments; such proceedings are dangerous for mother and child, and they are to be the more reprobated as the spasms are augmented by manipulation of the uterus. We must attend to the etiology of the case, and have a regard to the individual demands of the patient's constitution. Gastric irritation not unfrequently precedes, and an emetic given at the commencement of the attack may convert the spasmodic action into normal contractions. In plethoric well-fed females, of a rigid fibre, who have gained flesh during pregnancy, have often suffered from swellings of the feet and hands, and from cerebral and thoracic congestion, and whose entire habitus during the act of parturition proves the existence of plethora, by the brilliancy of the eyes, a red, livid face, increased temperature, accelerated, full, or hard pulse,—in such individuals antiphlogistic treatment should be adopted in its full extent; on the other hand, hysterical females, who have previously suffered from dysmenorrhœa or chlorosis, and were subject to spasms, with a pallid face, cool, dry skin, small, quick, thready pulse, great anxiety, and jactitation,—require antispasmodic and soothing remedies, in the shape of small doses of opium, ipecacuanha, a potash bath, oily inunctions, warm fomentations of the abdomen and genital organs, and enemata. The treatment must, in the second place, be modified according to the intensity and form of the spasm. When the contraction amounts to a stricture, it is necessary to induce a sudden collapse; and nothing is more effectual for this purpose than a copious venesection made while the patient is sitting up, followed by a full dose of opium. The experienced accoucheurs of our metropolis have not found that the application of belladonna ointment to the os uteri, so highly praised by some, is of any use. My esteemed friend, Dr. C. Mayer, has found the slow and careful injection of tepid oatmeal gruel, or water, into the cavity of the uterus, to be followed by very beneficial results in those cases in which after the waters have broken, the uterus firmly encircles the entire child. For those hurried pains, which are chiefly rendered dangerous by the supervening hemorrhage, Wigand recommends rest and the horizontal position in bed, and the exhibition of half a grain of opium, with from five to eight grains of nitrate of potash; if there be also an unusual rigidity of the os uteri, or the other parts of the sexual organs, a copious venæsection, even ad deliquium, may be advisable.

We possess no data to determine the existence of spasmodic action of the unimpregnated uterus. The absence of muscular fibres in the virgin uterus renders its occurrence impossible in that condition of the organ; but it has not been determined by the aid of the scalpel, or of the microscope, whether, in females who have borne children, the muscular tissue entirely disappears; both in the parenchyma of the uterus and in the round ligaments, the muscular tissue and its functions, have been established by the excellent researches of the second Meckel.[1] Reil[2] observes: "the uterus sometimes descends in a spasm to the vagina, with an insupportable sense of a hot body being forced out; when the spasm remits, the organ returns to its normal position." We can scarcely do otherwise than assume this statement to have been based upon a local examination, for the sensations of the patient are apt to deceive her; as in the case of hypogastric neuralgia, where, in spite of the sensations of weight and pressure upon the uterus and vagina, there is no change in the position or direction of these parts.

Besides the muscular fibres of the uterus, there is another muscle in the sphere of the female pudenda, which, though rarely, may be attacked by spasm. It is the constrictor cunni whose contraction is under cerebro-spinal influence, and may be effected spontaneously. The narrowing of the introitus vaginæ, which is thus induced, may amount to an actual constriction, as occasionally happens during cohabitation.

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[1] In—Rosenberger; Dissert. de viribus partum efficientibus generatim et de Utero speciatim, ratione substantiæ musculosæ et vasorum arteriosorum: Halæ, 1791.

[2] Archiv für Physiologie, vol. vii, p. 437

Spasm in the muscles of the male genital organs.—In adult rabbits, dogs and cats, Edward Weber[1] found that application of the conducting wires to the vasa deferentia, produced very vivid peristaltic contractions, so that they twisted and turned violently, and thus underwent a permanent change of position. In the male sex, the influence of the cerebellum upon the movements of the testicles and the vasa deferentia has been demonstrated by Budge, and fully confirmed by Valentin. The experiment is of sufficient interest to merit repetition in the words of the author: "By a lucky coincidence I made the gratifying observation, that in an old cat, whose testicles lay in the abdominal cavity, these organs immediately after death, moved, whenever the cerebellum was irritated with the scalpel, or with caustic potash. The effect was such, that whenever the right lobe of the cerebellum, and the right half of the vermiform process were irritated, movement of the left testis ensued, and the reverse. Mere superficial irritation sufficed to produce this result. The movement of the testicles soon became so palpable in this animal, that there could be no doubt as to its reality. I hastened to open the entire skull and the abdominal cavity, and found the testicles lying perfectly still, without any trace of movement. On irritating one side of the cerebellum, the testicle of the opposite side swelled, quitted its position, and rose up so as to form a right angle with the spermatic cord, one side of the angle being directed forwards. If I desisted from the irritation, the testicle returned to its position, and the movement was renewed on renewing the irritation; the experiment was repeated during half an hour with unvarying results. After the first irritation, not three seconds elapsed before the movement followed; subsequently the interval between the irritation and the effect was prolonged. The movement only lasted a short time, and diminished more and more. Alternately with the cerebellum I irritated the cerebrum, the corpora quadrigemina, the thalami optici, the corpora striata, but I have never seen the slightest movement result from the irritation of these parts. In the ductus deferens, the movements were alternately those of elevation and depression, an entire portion being distended and collapsing; in the testicle a general tumefaction of the organ was observed, although I also saw depressions form here and there."[1] To secure the success of the experiment, Valentin states that older animals should be selected, and especially such as are perfectly mature, or in the period of rutting, a remark which also applies to female animals. It is futile to experiment upon young animals. Volkmann[2] has performed five experiments of this kind without observing such phenomena; in one case only he saw the penis violently agitated. We can do no more than guess whether a convulsive increase of this action may take place in morbid states; the seminal discharges which so often occur in irritations of adjoining organs, the rectum and bladder, may be accounted for in this manner by reference to the reflex actions; even in health it is irritation of the glans penis which causes the ejaculatio seminis. Our knowledge of the spasmodic contractions of those muscles of the male organs of generation, voluntary or organic, which derive their motor power from the cerebro-spinal system, is not less incomplete. There are numerous affections which have hitherto been classed under different heads (satyriasis, chorda), which would with more propriety be considered at this point, as well as the spasmodic retention of the semen, of which Sauvages has communicated a few instances, (dyspermatismus hypertonicus and epilepticus.)[3]

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[1] Loc. cit., p. 27.

Not only those parts of the sexual organs which are destined for coition, but those also possessing formative powers, are subject to spasm. The testicles are liable to be attacked by a peculiar sense of pain and to be drawn up, sometimes on both, but more generally on one side only, and after the attack has ceased they return to their normal position. This convulsive action of the cremaster, which, like the ligamentum teres of the uterus, contains muscular fibres derived from the abdominal muscles, is very apt to associate itself with diseases of the kidneys, and sometimes with hemorrhoids and saturnine colic. I have already had occasion to observe (vol. I, page 285,) that it is sometimes induced by reflex action from irritation of sensitive fibres of the crural nerve.

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[1] Budge; Untersuchungen, No. I, p. 160.

[2] Handwörterbuch der Physiologie mit Rucksicht auf Physiologische Pathologie, Herausgegeben von Rudolph Wagner: Lief 4, p. 592.

[3] Nosol. Meth., ed. Daniel, vol. iv, p. 667.

CHAPTER XXI.

SPASMS FROM EXCITEMENT OF THE SPINAL CORD.

In our observations and interpretations of the morbid conditions of the spinal cord, we must bear in mind the physiological relations of the organ; while, on the one hand, it is a conductor of the brain, on the other it is a central organ of the nervous system, and as such possesses peculiar endowments.

I. SPASMS DEPENDENT UPON THE SPINAL CORD AS A CONDUCTOR.

Experimental results.—All the experiments hitherto instituted upon animals, show that the anterior columns of the spinal cord are the conductors of motility.[1] The entire absence of motility in the posterior columns has long continued subject to some doubts; the difficulty of isolating the irritation in them, and the admixture of reflex action, rendered the attainment of accurate results very difficult. The experiments, however, of Van Deen, Kürschner, Stilling, Longet, and Eigenbrodt, have placed the matter on a firmer basis. The movements themselves that result from irritation of anterior or posterior columns, differ in character. The former act like peripheral nerves; movements occur on the same side in muscles whose nerves are derived from the spinal cord, below the point injured; whilst in irritation of the posterior columns, the effect is neither confined to the side irritated, nor to the point to which the irritation is applied. It is scarcely possible to touch these parts without inducing movements of all the extremities. There are other experiments which, on account of the avoidance of the reflex phenomena, are yet more decisive. In decapitated animals, the point of a very sharp cataract knife was introduced into the spinal canal, and the membranes detached to a certain distance from the posterior columns;

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[1] Consult—Eigenbrodt; über die Leitungsgesetze im Rückenmarke: Giessen, 1849, pp. 32—35; a book containing the most recent experiments.

incisions were then made into the middle line, and at the side of the posterior columns, without dragging or injuring the anterior columns; no movement or tremor resulted, though it occurred instantly when the point of the knife was lowered, or passed over the anterior columns.[1] In most recent times, we have received a not unimportant proof, through the narcotic effects produced by the inhalation of ether. In animals that have been perfectly etherised, the electric stimulus excites no effect upon the sensory nerves, but a very marked one in the anterior cords, even when a mechanical stimulus has ceased to produce any effect.[2]

The physiological character marking the convulsions dependent upon the spinal cord as a conductor, is the fact, that the spasmodic symptoms occur on the same side as the one on which the disease is seated. The irritated spinal cord reacts with all the motor fibres which correspond to the extent of the irritant cause, and induces convulsions of those muscles which receive their impulse from this point. Upon this fact we base our diagnosis of the seat of the disease in the different regions of the spinal cord.

Surgical observations would undoubtedly afford the most distinct picture of these spinal spasms; but the injuries of the spinal cord are almost invariably followed by a loss of movement only, as I have already had an opportunity to observe in reference to sensation, (vol. I, page 149.) I have compared the works of Ollivier and others for this purpose, but have not found a satisfactory instance. In morbid states which affect the spinal cord as a conducting apparatus, and are associated with convulsions, the sensory as well as the motor sphere is generally implicated; the affection of the former being manifested by exalted or diminished sensibility.

Processes which take their origin in the blood not unfrequently act upon the spinal cord as a conductor. The doctrine of congestions presents many weak points and defects to criticism; but we cannot refuse to admit the reality of cases in which we must attribute the local or general convulsions following suppressed hæmorrhage, especially hæmorrhoidal and menstrual, to hyperæmia of the spinal cord. The observations of spasm brought on by congestion and hæmorrhage between the meninges of the spinal cord are still more valuable; the seat of the convulsive action in these cases depends upon the seat of the lesion.[1] But it is not plethora only, but also anæmia, which causes a convulsive reaction of the spinal cord. Hippocrates observes that similar effects result from hæmorrhage, or the sudden abstraction of large quantities of blood.

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[1] Marshall Hall; Abhandlungen über das Nervensystem, aus dem Englischen mit Erläuterungen und Zusätzen von Kürschner; Marburg, 1840, pp. 195—202.

[2] Longet; Expériences relatives aux Effets de l'Inhalation de l'Ether Sulfurique sur le Système Nerveux: Paris, 1847, p. 12.

Besides the alterations as to the quantity of the blood in its relations to spinal convulsions, we must also consider the qualitative changes bearing upon this point. The toxicological experiments performed in modern times have afforded some elucidation on these subjects. The universal convulsions resulting from poisoning by strychnine, when introduced by the mouth, are brought about solely by the influence of the poisoned blood upon the spinal cord; for if, as Stannius[2] has demonstrated, the posterior half of the vertebral column and the spinal cord of a frog, with all the nerves appertaining to it, be separated from every connection with the vascular system, no convulsions occur in the posterior extremities after the application of the strychnine, whilst the phenomena of poisoning are vividly manifested in the anterior extremities. The experiments of Stilling[3] on the communication of the poison by the circulation of the blood in the spinal cord, while it is continuous at one point, by the agency of the close interlacement of capillary network within its substance, are yet more instructive and decisive. Backer[4] had already shown formerly that, even after dividing the spinal cord in dogs, large doses of nux vomica taken by the mouth produced convulsions in the paralysed parts lying below the point of division, —a fact which can only be explained by assuming the agency of the blood. The symptoms occurred the more rapidly if the animal had fasted previously, and also more speedily when the powder was given in a liquid vehicle than in substance. Other poisons operate in a similar manner. We could scarcely find a more appropriate place for the investigation of the creeping disease, as a convulsive affection arising from poisoned blood, than the present.

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[1] Ollivier; Traité des Maladies de la Moëlle Epinière, 3d ed., vol. ii, p. 119.

[2] Stannius; über die Einwirkung des Strychnins auf das Nervensystem, in Müller's Archiv, 1837, p. 229.

[3] Stilling; Untersuchungen über die Functionen des Rückenmarks und der Nerven: Leipzig, 1842, p. 50.

[4] Backer; Commentatio ad quæstionem physiologicam a Facultate Medica, Rheno-Traject. anno 1828 propositam, &c., pp. 139—154.

CONVULSIO CEREALIS.

Morbus epidemicus convulsivus, raphania, ergotism.

The opinion began to prevail that this affection had become a matter of history, when its occurrence during the last decennia, in certain districts of Germany, though not in the epidemic extension with which it appeared in the 18th century and earlier, again attracted attention.

According to the observations of Wichmann,[1] Taube,[2] and the officer of health, Dr. Wagner,[3] the disease is characterised by the following symptoms:

Many patients experience premonitory symptoms in the shape of painful oppression at the pit of the stomach, heaviness of the head, vertigo, dyspnœa, weakness and debility of the legs. In others the disease at once commences with formication and cutaneous anæsthesia at the tips of the fingers, extending to the arms and legs, and occasionally affecting the face and the tongue. The hands and feet are attacked with cramps of the flexor muscles. The fingers of both hands are bent like hooks, the thumb being pushed under the fore and middle finger in an oblique direction; the wrist is strongly curved inwards, so that the hand assumes the shape of an eagle's beak. The toes are also doubled under the sole of the foot. The spasm extends over the fore and upper arm, which are bent upon one another at an acute angle; over the thigh and legs, and sometimes to the muscles of the nape and of mastication. Trismus and opisthotonos supervene. The spasms, which are generally most violent from morning to the middle of the day, and then diminish or cease entirely, are accompanied by a violent sense of pain, which remits on extension; for which reason the patients urgently implore their friends to stretch their limbs. Consciousness and the activity of the senses is generally unimpaired. The pupil is almost always dilated. Bulimia is rarely absent. The renal secretions and the intestinal evacuations are normal. The skin is of an earthy hue, dry, and covered with perspiration during the convulsions. The pulse and respirations are of normal frequency. The disease may remain at this point, or increase in frequency; in the latter case the convulsions become more violent, and assume an epileptic character; delirium supervenes, and even an idiotic state often presents itself. The lower extremities become paralysed, and the arms tremble. The anæsthesia is so considerable that the patients can expose their hands to the flame of a candle, or hold burning coals, without experiencing any sensation whatever. But the disease is not always developed to such an extent; at times it supervenes suddenly, with violent convulsions, tetanus, orthopnœa, ischuria, vomiting, and sopor.

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[1] Kleine Medicinische Schriften, p. 12.

[2] Die Geschichte der Kriebelkrankheit: Göttingen, 1782.

[3] Hufeland und Osann's Journal der Prakt. Heilkunde, 1831, 1832, 1839.

When complicated with other diseases, such as smallpox, cholera, inflammations, Wichmann, Wagner, and others have observed that the course of the creeping disease is not interfered with.

The duration of the slighter varieties of the disease extends to three weeks and more, while the violent attacks last a few days. The restoration of health is accompanied by an eruption of furunculi and ecthyma, or by a copious discharge of worms of the genus lumbricus or oxyuris, the rapid and multitudinous production of which parasites in the creeping disease was first pointed out by Taube. The same writer also directs attention to a peculiar change occurring in the nails of several patients. "The nails presented as many as four rough and dark-brown elevated ridges, half a line in breadth, alternating with smooth parts; subsequently I found that, by counting these layers, I was able to inform the patient how often he had been affected, and I never failed in my estimate. After recovery, the growth of the nails removed the roughness, and the surface regained the same smoothness it possessed before the illness."

Relapses and secondary diseases are of frequent occurrence; the former are induced by cold, by a damp and cold atmosphere, and by emotions, even months after the original attack has subsided. Among the secondary diseases, idiocy, epilepsy, and paraplegia are the most frequent; affections of the intestinal canal, chronic diarrhœa, derangements in the functions of nutrition, tabes, and dropsies are also met with. In the violent cases, death sometimes supervenes rapidly, or is induced during the relapses by apoplexy or suffocation.

We possess no cadaveric investigations which could satisfy even moderate demands. The various observers agree as to the fact of the rapid supervention of putrefaction after death.

Careful demonstration has proved incontrovertibly that the exciting cause of the creeping disease is the consumption of rye, which is damaged by the admixture of ergot (secale cornutum). The majority of the older observers agreed as to this point, and in recent times the disease has been exclusively met with where poisoning of this description was traceable.[1] In order to render assurance doubly sure, experiments were instituted both on human beings and animals; although they could not be continued for a sufficient length of time in the former, and the symptoms produced in the latter did not entirely correspond with those of the creeping disease, the results sufficed to prove that the degeneration of the seed produced by entophyta, small fungoid growths (Sphacelia Nees.), termed ergot (mutterkorn), and occurring almost exclusively in rye, produces an injurious effect upon the brain and exerts a specific influence upon the spinal cord. A great deal depends upon the dose and form in which the substance enters the organism. From the experiments instituted by Wright[2] upon animals, with exemplary accuracy, we ascertain: 1. That when the poison is introduced directly into the blood by injection into the veins or arteries, the brain and spinal cord at once become affected; whereas if the ergot is taken by the mouth, symptoms of local irritation of the stomach or rectum precede. 2. That the spinal symptoms (paraplegia or spasms) may precede or follow the cerebral (sopor, &c.). 3. That a concentrated large dose instantly paralyses the powers of the nervous system, whilst smaller doses first induce excitement, and are followed by a diminution of the powers; a very diluted solution producing a gradual sedative action, and exhausting the vital powers, while a different reaction is manifested in different animals, graminivora being less affected than carnivora. In the same way mankind are differently influenced by the ergot, according to the quantity and form in which it is taken. The larger the quantity, and the fresher the ergot, especially if baked in bread or cake, the more certain the disease is to follow; whilst a watery infusion of the secale produces no such effect, but exerts a specific influence upon the motor nerves of the uterus, which is not observed in the consumption of ergot as an article of diet. Taube mentions expressly that pregnancy runs its due course in an ergotised subject. Wright has demonstrated the presence of secale cornutum in the blood of animals poisoned by it; on treating the blood with sulphuric ether, he found it to contain the ethereal oil of secale previously discovered by himself;[1] this oil is recommended as one of the most effectual remedies for the promotion of the labour pains, and for the arrest of violent metrorrhagia, as also for other conditions, especially gastrodynia, in doses of from 20 to 50 drops.[2]

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[1] See Lorinser; Versuche und Beobachtungen über die Wirkung des Mutterkorns auf den menschlichen und thierischen Körper: Berlin, 1824, pp. 47—60; and Wagner, loc. cit.

[2] An Experimental Inquiry into the physiological action of the Ergot of Rye, in Edinb. Med. and Surg. Journal, vol. lii, pp. 293—334; vol. liii, pp. 1—35; vol. liv, pp. 51—62.

The deleterious influence of secale cornutum upon the human body, is promoted by certain influences. One of these is age; Wagner has found that infancy and youth are most liable to raphania; he met with no case of it after the age of fifty. The mode of life is a still more fertile source; a glaring instance of this is presented to us in the inhabitants of the flats of Lüneburg, of whom Wichmann gives the following description: excepting buck-wheat, honey, and possibly a small quantity of milk, their sole food is rye-meal; the majority of the people had so entirely consumed the last year's supplies of rye, that they did not wait till the rye was thrashed, but as soon as the harvest was brought in, used the grains that fell out spontaneously. These were at once converted into bread, or a vile kind of indigestible cake, dumplings, or porridge, so that their sole article of diet throughout the day was rye-meal. Their beverage was water by itself, or with an addition of honey; at times a glass of brandy was indulged in. Honey was used as a substitute for butter.[3] We may also assume endemic and epidemic influences to be at work, from the great extension of the disease during the sixteenth and seventeenth centuries. Lastly, it is undeniable that the emotions and cold induce a more rapid appearance, and a more frequent return of the disease.

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[1] Loc. cit., p. 112.

[2] Vol. liv, p. 60.

[3] Edinb. Med. and Surg. Journ., 1840, vol. liii, p. 5.

The ratio of mortality, according to the reports of the physicians of the last century, was from 6 to 9 per cent. Of 600 patients treated by Taube, 97 died, among 429 attended by Dr. Evers, there were 45 deaths.[1] The greatest mortality in either sex occurred between the second and tenth years, the lowest between the age of twenty and thirty. The greatest danger threatens during the height of the paroxysms of the disease. Wagner states that deficient reaction of the intestinal canal, trismus, and extension and adhesion are grounds for a very unfavorable prognosis.

Without the interference of the board of health, treatment is not likely to prove effectual. The authorities should provide ripe old corn for those parties who have no other resources but the new supplies, and they should confiscate the unsound fresh grain. It will be even necessary in such a case to employ force, for mild arguments are not likely to avail much with peasants, who are affected with a disease accompanied by a ravenous appetite. The most suitable treatment consists in evacuating the intestinal canal both by emetics and purgatives; it is not to be forgotten that a great torpor exists; Taube found that it was often necessary to give as much as twenty grains of tartrate of antimony before it produced the desired effect. The best purgative is calomel, in doses of from ten to thirty grains, and it proved the more effectual the more worms passed off. After the evacuations, Wagner recommended the exhibition of opium, which is the more beneficial if perspiration supervenes. If it fails in producing the effect, the exhibition of camphor is recommended; Taube for the same purpose employed warm baths. The painful spasms are best relieved by friction with a warm hand, and especially by extending and bending the limbs with some force. When there is a complication with inflammatory and congestive affections, we are not to be deterred from abstracting blood. Taube gives the preference to the local abstraction, and adds, that the leeches which had been applied once to such patients, invariably died.

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[1] Taube: loc. cit., p. 827.

SPINAL MENINGITIS.

Among the morbid processes affecting the spinal cord, as a conducting apparatus, inflammation is the most frequent, and it is manifested by corresponding symptoms. Inflammation of the meninges presents features of a convulsive character, it is a subject to which I shall return when I arrive at the description of the diseases affecting the formative sphere (Bildungs-sphäre) of the nervous apparatus.[1]

In spinal meningitis, it is the muscles of the back and neck which are chiefly liable to spasms, varying in degree from mere muscular rigidity to the most forcible contractions, by which the trunk and the head are drawn back. The cramp is rarely persistent, being generally remittent, and recurring spontaneously after a pause, or as soon as the patient is required to make a movement with his trunk. Violent pain is a uniform accompaniment; it is permanent in one point, even during the intervals of the spasms, or is felt all down the back, and attains the highest pitch when the patient attempts to move. In little children I have repeatedly found tubercular meningitis confined to the cervical region, the medulla oblongata, and the cerebellum, while the muscular spasm was limited to a permanent bending back of the head, a species of meningitis which has not yet been accurately described, and may be confounded with incipient disease of the cervical vertebræ.

On the 17th of July, 1832, I was called to see a boy of six months, who was suckled by a healthy mother, but had been ill for a fortnight, a circumstance attributed to a fall from the arm of his nurse. The child lay asleep in his cradle, with his head bent back; and it was unable to change the position of the head spontaneously. If I made the attempt to move it with some force, the child's face became crimson, and he uttered a loud scream. The cervical muscles were tense and stretched. The functions of the brain continued unimpaired, the eye was animated, and the pupil contracted duly. Nutrition was carried on well; from time to time, there were slight twitchings of the extremities, and finally, profound sopor.

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[1] [This part of the work has not yet appeared in the original; see Editor's Preface.]—Ed.

Death occurred after the disease had lasted four weeks, with violent and enduring convulsions. On examining the cavity of the skull, I found that there was considerable congestion on the surface, and within the brain plastic exudation along the falx, with enormous distension and accumulation of serum in the ventricles, so that on accidentally opening one of them, two teacupfuls of a clear serous fluid issued like a fountain. The form of the ventricle was considerably enlarged. The septum and the walls of the lateral ventricle were softened. The pia mater and arachnoid of the inferior surface of the cerebellum were firmly adherent to each other, and converted into a granular tissue, which presented a rough surface; in this a large number of tubercles of the size of millet seeds, were deposited, forming a tumid mass. The pia mater and arachnoid presented this degeneration, as far as I was able to reach down the vertebral canal with my finger. On lowering the head, a considerable quantity of clear serum ran out of the vertebral canal.

Before the post-mortem took place, I had indicated to several of my colleagues the seat of the lesion, my views of its character being determined by the analogy of the case to a similar one, which I had met with a short time previously. In the month of March, 1832, I was consulted about a female child of six months, which for nine weeks previously had been affected with a rigid retroversion of the head. It could not by any means be bent forwards or to one side. The cervical muscles were very stiff and hard; at the same time there was an almost continuous state of sopor and dilatation of the pupils; the infant, however, continued to take the breast. The upper and inferior extremities were paralysed, emaciated, and flabby. On making the cadaveric examination, I discovered a considerable accumulation of serum in the cerebral cavities, which were dilated to three times their normal size. The foramen Monroi was large enough to admit of the first joint of the thumb. The choroid plexuses contained hydatids. On raising the cerebellum, a serous cyst of the size of a small apple appeared, which was lacerated on attempting its removal, and discharged a considerable quantity of serum. On prosecuting the minute examination, in which I engaged the assistance of my friend, Professor Schlemm, it appeared that the arachnoid, at the point at which it is reverted from the cerebellum to the upper (posterior) surface of the medulla oblongata, was dilated so as to form a blind sac, terminating in an obtuse point. The arachnoid itself was much thickened and of firm consistency. (The preparation has been put up in the museum of the Berlin University.)

The two cases just related, present another feature of interest. In the first there was no sopor nor any other marked disturbance of the functions of the brain or the senses, until shortly before death, in spite of the hydrocephalus; in the second there was paralysis of the extremities, in addition to the constant sopor. This difference in the symptoms I account for, by the free communication which existed in one child between the serum of the cerebrum and of the vertebral canal, and which was favoured by the retroversion of the head; while in the other, this was interrupted by the saccular dilatation of the arachnoid, which necessarily induced considerable pressure upon the brain and the upper part of the spinal cord.

CHAPTER XXII.

SPINAL SPASMS.

CHOREA.—ST. VITUS' DANCE.

The spinal cord considered as an apparatus of conduction, differs from the peripheral tracts in this, that it not only contains the aggregate of the primitive nervous fibrils, but is also provided with a peculiar arrangement of the fibrils in groups, which renders the excitement of definite kinds of movement possible. As such we must consider the antagonistic and combined movements, which do not require the cooperation of the brain, as proved by experiments performed upon decapitated animals. After removing the brain, we not only see flexion and extension, abduction and adduction, pronation and supination effected, but even find entire series of movements take place, which resemble the normal movements excited by a mental impression for a definite object; thus decapitated geese flap their wings, frogs without their heads exchange the extended lying position for a sitting one, and draw their paws under their belly when they are irritated,[1] &c. These associated movements take place both when peripheral sensory nerves, as well as sectional surfaces of the spinal cord are irritated, and it would appear that the seat of the irritation bears a close relation to the combinations of the motor nerves, and the forms of movement thus induced. Engelhardt was the first to point out that there is a definite antagonism between the functions of the upper and lower half of the spinal cord. Irritation of the spinal cord, by introducing a wire, or by removing individual vertebræ with the contained portion of medulla, as far as the fourth vertebra, produced marked flexion-movements of the limbs; the same species of irritation applied to the remainder of the spinal cord, induced extension movements. The reflex movements were manifested in the same manner, as long as the cord had not been removed as far as the division between the fourth and fifth vertebræ; only flexion-movements were induced in the extremity of which the toes had been pinched, as well as in its fellow.[1] It appears from a few experiments instituted by Valentin, that we may at will induce movements of abduction and extension in decapitated frogs, by irritating the skin of the back at any point, and that again we may cause the movements of adduction and flexion by irritating the skin of the abdomen.[2] Marshall Hall[3] quotes a case of paraplegia and anæsthesia resulting from kyphosis, in which similar symptoms presented themselves. On rubbing the abdominal surface, and the os ilium of the right side, which was deprived of sensation, forcible extension of the right leg ensued at once, (the same was also the case in an observation quoted from Budd further on, see also vol. I, p. 271,) whereas rubbing of the sacral region at once induced flexion of the knee and the thigh.

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[1] Volkmann; über Reflexbewegungen, in Müller's Archiv, 1838, p. 22.

A due estimation of the mechanism and the functions of the spinal cord by which these movements are grouped together, throws a light upon a disease which has hitherto given rise to much confusion. I allude to the malady known by the familiar term of St. Vitus' dance.

The chief features of this affection consist in combined movements of one or more groups of muscles, independent of cerebral influence, increasing in violence when predetermined movements are attempted, and more or less interfering with the latter. The different forms which the disease assumes have not as yet been sufficiently investigated; the one best known is that occurring in childhood, a sketch of which may serve as our prototype.

The disease for the most part commences gradually, with slight symptoms, which are generally not attended to, or misunderstood. The voluntary movements are unsteady, they are performed clumsily and hastily; the posture is vacillating, so that the patients are unable to sit still for any length of time without moving about on the chair, and moving the arms and legs. There is already a frequent and rapid alternation between supination and pronation, adduction and abduction of the hand, causing any object which was grasped to fall. As the disease progresses, these movements increase in extent and intensity. The arm is jerked up, and thrown forwards, backwards, or laterally; the leg is rotated inwards, and as rapidly outwards. The muscles of the neck and face participate in this irregular action. The head turns with great rapidity to one side or the other; the mouth and the eye open and close; the angle of the lips is distorted, and again resumes its position; the bulb rolls and squints, and the tongue is protruded. Later on, the muscles of the trunk are involved, and all movements, though still occurring in associated groups, degenerate into a violent throwing and tossing. Even the trunk is thrown up, and it becomes a matter of difficulty to keep the patient on his bed. Excoriations and ulcers sometimes result from the violence of the concussion and friction. The muscles of the external and internal respiratory apparatus are rarely attacked; I have only met with three instances in which it occurred. In my work 'Klinische Ergebnisse,'[1] I have related the case of a female, aged 48, who had for eight years been affected with chorea, resulting from a heavy labour. The patient at the same time suffered from an annoying hiccough; inspiration was often accelerated, and accompanied by a loud whistling sound, such as we meet with in contractions of the glottis. In a child of eight years, the choreic movements of the right half of the body were associated with dyspnœa, whistling inspiration, and palpitation. The third case occurred in a boy of eight years, who, without any known cause, was attacked with chorea about Easter in 1847. At first only the muscles of the extremities, of the face, and the eyes were attacked. The affection subsequently left these parts, and seized upon the muscles of respiration. When, in the month of January, 1848, the boy was brought to the hospital, every now and then a rapid and short concussion of the thorax was perceived, invariably accompanied by a brief, snapping noise. When examined naked, it proved that the attack involved the inspiratory muscles, and especially the intercostals, which were quickly drawn inwards. The snap in this case also originated in a spasmodic condition of the glottis. At times, flexion and extension movements were still observed to take place in the upper extremities. Sulphate of zinc and Fowler's solution were prescribed, but proved unavailing. In the beginning of March the affection had extended to the face; tepid baths, with cold affusion of the head and back, were now ordered, and in about five months a cure was effected. Two years have elapsed since and no relapse has occurred.

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[1] Müller's Archiv, 1841, pp. 206—209.—See also: Harless; über die functionell verschiedenen Partieen des Rückenmarks der Amphibien, in Müller's Archiv, 1846, p. 74.

[2] Valentin; de Functionibus Nervorum Cerebralium, p. 101.

[3] On the Diseases and Derangements of the Nervous System: London, 1841, p. 247.

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[1] Berlin, 1846, p. 20.

In the majority of instances both sides of the body are affected in chorea; it less frequently attacks only one side; according to Wicke[1] it was unilateral in 58 cases, and universal in 91, out of a total of 149. The statement made by Rufz and others that the left side is more violently and more frequently affected than the right, has not been confirmed. In the 58 cases mentioned by Wicke, the disease affected the left side in 23, the right in 26 instances; in 1 it passed from the left to the right, and in 8 the affected side was not specified. The inferior extremities are never attacked alone, which is sometimes the case with the upper. The relation existing between the voluntary and the spasmodic movements is characteristic; the former almost invariably pass into the latter, and are the more prone to do this the higher the degree of association required. Thus, standing and walking are rendered difficult, grasping certain objects is yet more interfered with, and even becomes impossible. Sydenham,[2] who has also sketched this disease with a masterly hand, already states, that before the patient can raise the cup to his lips he "makes as many gesticulations as a mountebank, since he does not move it in a straight line, but has his hand drawn aside by spasms, until by some good fortune he brings it at last to his mouth; he then gulps it off at once, and so greedily as if he were trying to amuse the lookers-on." If the patient is required to put out his tongue, and to keep it out, he experiences great difficulty in doing it, the tongue is generally drawn back with a jerk. Lastly, we find the combined movements of speaking and swallowing rendered very difficult and interrupted; indistinct speech, stammering and stuttering are very frequent symptoms of the affection. The numerous sympathetic movements are characteristic; the majority of patients are unable to execute any movement determined upon, by itself. The influence of the will upon the spasmodic movements is very limited in the majority of instances. In spite of my frequent and urgent request that the patient should maintain his arm for a time in a definite position, the majority of patients were only able to do so for a brief period; nor does it suffice to support and hold the limbs. On the other hand a remission and pause in the movements occur during a quiet sleep, while, as Marshall Hall has observed, the movements continue if the patient dreams. Watson[1] also states that the movements make a pause during a long drawn inspiration. The relation between sensation and motion is no less deserving of attention; however severe and frequent the movements may be, there is no sense of fatigue or inconvenience. The production of motor power is almost always diminished, hence the relaxed state of the extremities and the incapacity for endurance and fatigue. Except in complications no psychical disturbances are manifested. The movements dependent upon sympathetic nervous influences are generally undisturbed; I have never, although I have especially attended to this point, observed any deviation in the rhythm of the heart's movements. It is not unusual to see rapid growth and emaciation during and after the disease.

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[1] Versuch einer Monographie des grossen Veitstanzes und der unwillkührlichen Muskelbewegung, nebst Bemerkungen über den Taranteltanz und die Beriberi: Leipzig, 1844, p. 278.

[2] Sydenham Society's English Edition, vol. ii, p. 258.—Processus Integri, xvi.

The symptoms above detailed generally continue with trifling intermissions, and with but slight remissions in the waking state, for one or several months. It rarely runs a prolonged course, enduring for a series of years, but when this is the case it is less violent, and is confined to single groups of muscles.

The disease may be complicated with other morbid affections, without any interruption or modification of the course of the chorea. Cerebral symptoms often supervene, such as excitement, delirium, mental obtuseness, and sometimes even inflammatory conditions. Bright[2] has found that rheumatic affections, both articular rheumatism and rheumatic pericarditis, are frequent complications and causes of the complaint; my own experience and that of other writers does not coincide with this opinion. I have never omitted examining the heart in chorea patients, even when there were no functional disturbances to draw attention to the organ; but with the exception of two cases, in which the complication was accidental, and in one of which it was only observed after the fifth relapse, brought on by a rheumatic attack, I have not found chorea accompanied by disease of the heart. Addison and Babington,[1] in a great number of instances, have found the first sound of the heart accompanied by a soft bellows murmur. I have only met with murmurs, in chorea patients, in the vessels of the neck, and occasionally in the aorta, in the vicinity of the semilunar valves; but they were solely referable to the anæmic condition of the patient, which gave rise to or accompanied the disease; and they disappeared after a persevering employment of steel medicines. The complication with acute exanthemata, inflammation of the intestines or the lungs, or with pertussis, produces no change in the symptoms of chorea; but the supervening disease is apt, according to Guersant, to assume an asthenic type.[2]

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[1] Lectures on the Principles and Practice of Physic, 2d ed., 1845, vol. i, p. 641,

[2] Reports of Medical Cases, vol. ii, p. 493; and Medico-Chir. Trans., vol. xxii, p. 10.

Among the predisposing causes the chief is a certain period of life, the greatest susceptibility existing between the second dentition and puberty, especially between the age of ten and fifteen; the second is sex, more than twice as many occurring in females than in males.

From Wicke's[3] collection of 327 Cases, we find that there were 210 females to 117 males; the following table shows the respective ages at which they occurred:

Age.	Males.	Females.	Total.
4	1	4	5
5	5	3	8
6	13	4	17
7	7	16	23
8	5	10	15
9	12	22	34
10	15	28	43
11	13	26	39
12	12	21	33
13	6	18	24
14	11	19	30
15	4	14	18
16	6	5	11
17	6	10	16
18	1	6	7
19	0	4	4
	117	210	327

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[1] Babington; On Chorea, in Guy's Hosp. Reports, 1841, vol. vi, p. 415.

[2] See—Rufz; sur la Chorée, in Archives Génér. de Méd., February, 1834.

[3] Loc. cit., p. 302.

Rufz states that during ten years (from 1824–1833) there were admitted into the Children's Hospital, at Paris, 32,976 patients, of which 17,213 were boys, and 15,763 girls. Among these, there were 189 cases of chorea, distributed in the following manner :—

Age.	Boys.	Girls.	Total.
1— 4	3	2	5
4— 6	2	3	5
6—10	16	45	61
10—15	30	88	118
	51	138	189

Among 100 Cases collected by Hughes,[1] there were :

Up to the 10th year . . .	33 cases,	11 boys,	22 girls.
From the 10th to the 15th year .	45 „	11 „	34 „
Above the 15th year . . .	22 „	5 „	17 „

The disease appears to occur much more frequently in the northern than in the southern latitudes. It has not been seen in the tropics by physicians who have resided there for a long time (Rochoux, and others). It is rare to trace an hereditary predisposition. Mayo relates a case of congenital chorea and idiocy.[2] The most frequent exciting causes are emotions, and especially fright, they occasionally induce the disease suddenly; thus I remember having a girl of ten years under my care, who was violently alarmed one morning by a dog jumping at her and barking, and was seized with chorea the same evening. When a considerable period supervenes between the causes and the effect, it is probable that trifling symptoms have been overlooked. A mere emotional influence, such as the embarrassment caused by being observed by others, often increases the intensity of the spasmodic movements. It can scarcely be shown to be produced by irritation. Reflex irritation most frequently resides in the intestines and genital organs; but under this head a more important part has been ascribed to helminthiasis than it is found to merit on closer examination.

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[1] Digest of One Hundred Cases of Chorea treated in the Hospital, Guy's Hospital Reports, 1846, 2d Series, vol. iv, p. 372.

[2] Outlines of Human Pathology, p. 170.

The frequent occurrence of chorea before the first supervention of the catamenia, or during amenorrhœa, or even during pregnancy, proves that the uterine system may be the source of the irritation. I have myself met with three cases of this kind. The first, which has been carefully described by a former pupil of mine, Julius Beer, in his inaugural dissertation: Choreæ casus, singulari complicatione insignis (Berolini, 1846) affected a girl of twenty years of age, the daughter of a fisherman, whose grandmother had died insane, and whose mother was subject at every confinement to eclampsia, and yet continues to suffer from daily attacks of catalepsy. In her tenth year, the patient had passed through a slight degree of chorea, and began to menstruate in her fifteenth. On the 23d Oct. 1845, she presented herself among the out-patients of the hospital with violent choreic movements, which for three months past had affected the upper and lower extremities, the face and the tongue. A frequent chattering of the jaws proved the muscles of mastication to be also involved. The movements increased during rough weather, and were so intense, as entirely to prevent her sleeping. The spasms were accompanied by mental excitement. The cause to which the girl attributed her complaint was suppression of menstruation, brought on by her having thrown herself into the water in play four months previously. On close inquiry this cause was confirmed; but it also appeared that there was a pregnancy of the same date, and numerous incidental mental emotions. A venesection was ordered, and cooling laxatives exhibited, without producing any relief. The movements became so violent that the patient was repeatedly thrown out of bed, and the influence of the will upon the muscles was so entirely abolished, that in order to feed her, it was necessary to hold the head and administer food by a spoon. The power of speech was entirely destroyed, and only a convulsive cry was uttered from time to time. These circumstances seemed to justify her admission into the general hospital, where she became the patient of Dr. Wolff. It became necessary to tie her down in her bed, which was violently shaken by the convulsions. It was impossible to avoid injuries, and one of the large toes was attacked with phlegmonous erysipelas. Consciousness was unimpaired. The pulse, counted at the carotids, was 120. A venesection to the amount of three ounces and one minim of hydrocyanic acid every hour, were prescribed. On the succeeding day, violent spasmodic labour pains came on, and the patient miscarried with a fœtus of apparently six months old. Soon after, violent convulsions ensued, which lasted through the night. The lochia were normal. The patient had no knowledge of the occurrence of parturition; a drop and a half of hydrocyanic acid being given hourly. On the following day a douche of ten pails of water, at a height of seven feet, was thrown upon the neck of the patient. The night was calmer, and the chorea movements were diminished. On the sixth day after the delivery, a visit from her lover caused a fresh outbreak of violent convulsions, which was calmed by repeating the hydrocyanic acid. Both phalanges of the great toe became gangrenous, and were removed at the wish of the patient. The chorea gradually ceased, and six weeks after, the patient was discharged cured.

The second case, a woman of 23 years of age, who had not been affected with chorea either during her childhood or during her first pregnancy, applied at the hospital on the 8th May, 1846. Four months previously her courses had ceased; she had a peculiar voluble utterance, and there were continuous involuntary movements of both arms and legs. This condition had commenced three weeks previously; it was not noticed by the patient until pointed out to her by her friends. The vaginal examination, which Dr. Schöller made at my request, showed that she was advanced to the fourth month of pregnancy. The movements diminished on the exhibition of sulphate of zinc, and the prolonged use of an infusion of valerian; but they continued up to the delivery at the full period, after which they gradually disappeared.

The third patient was a woman of 24 years of age, who, according to the report of her medical attendant, had previous to the occurrence of menstruation suffered from a severe attack of chorea, with impeded articulation. In her seventeenth year, menstruation was scanty and irregular, and her appearance rather anæmic. From time to time a hesitation in her speech occurred. She married in her eighteenth year, and a few months later becoming pregnant, she was attacked with chorea, the extremities on both sides and the tongue being violently moved. The employment of oxide of zinc, and valerian, and tepid salt baths, with cold affusion, removed the chorea towards the middle period of pregnancy. The delivery and the confinement ran the normal course; a few months later the woman again became pregnant, and remained well during the first half of the term; but was again attacked with chorea during the second half of pregnancy, when it assumed even greater violence than before, but disappeared on the employment of the same remedies. The delivery and the puerperal state passed off without disturbance this time also; four months later she became pregnant for the fourth time, and now the chorea did not reappear.

The following are the results which I have arrived at by a comparison with other cases of chorea occurring in pregnant women. In the majority of cases there had been no chorea in early life, there had been none, for instance, in the five cases observed by Dr. Lever.[1] Several females were exempt during the first pregnancy, and were attacked with chorea during the second. In two cases the chorea returned during the following pregnancy. In a healthy female of 20 years of age, a miscarriage occurred in the third month of the second pregnancy, and a fortnight after she was attacked with chorea of the right side, during the course of which the patient conceived for a third time. The spasms now increased in intensity, and soon after she had quickened, the left side was also attacked. The chorea generally commences at about the third or fourth month of pregnancy, it rarely occurs earlier, and still less frequently during the later months. The period at which it ceases varies, in a few it yielded during the pregnancy to the employment of the suitable remedies; in others it ceased gradually after a miscarriage, and but rarely at once; in others, again, it continued to the full period; in two of the cases communicated by Lever, the choreic movements ceased with the first occurrence of labour pains, never to return. In these patients the puerperal state passed off without any disturbance, and the children presented no abnormal characters. In the symptoms presented by these cases, some peculiarities are observable. The chorea of pregnant females is almost always bilateral, the muscles of the face and the tongue are invariably affected. The intensity of the movements is very marked, and they are often complicated with convulsions of an epileptic character. Many complain of a sense of numbness in the affected parts. The brain is almost invariably affected, and this is shown by headache, vertigo, a wild expression of the features, rolling eyes, unconnected speech, loss of memory, and great irritability. A Jewess, whom Peter Frank[1] had successfully treated when suffering from chorea as a girl, was attacked fifteen years later, shortly after marriage, at the commencement of pregnancy, with chorea more intense than he had witnessed during a practice of fifty years. The spasmodic movements continued day and night, and although perfectly conscious there was the most violent behaviour. The integuments were covered with furuncles and gangrenous spots; all the remedies employed produced no effect, miscarriage ensued at the fifth month, and health was restored at the same time. Ingleby relates the case of a female in the last month of pregnancy, who, for six weeks, had been suffering from violent headache. Soon after a venesection convulsions of the facial muscles supervened, which were communicated to the left arm, and after a second bleeding spread over the greater part of the body. On the evening of the fifth day, the disease attained an alarming height; the patient spoke loud and rapidly, and almost unceasingly, though her conciousness was unimpaired; the movements were so violent and universal that it was necessary to hold her down by force. As, at the same time, parturient pains manifested themselves, it was deemed advisable to rupture the membranes, upon which a dead child was born, without, however, in any way diminishing the spasmodic symptoms. After a short sleep produced by opium, the movements became so much aggravated, that six persons were scarcely able to restrain her. Twenty-four hours later death ensued with symptoms of extreme exhaustion.

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[1] On some Disorders of the Nervous System associated with Pregnancy and Parturition, Guy's Hospital Reports, 2d series, vol. v, pp. 3—12, and vol. vi, pp. 233—237.

It is quite exceptional to find chorea occurring after delivery, whether at the full period or premature. In the month of August, 1843, a female aged 47, was sent to the hospital, who, nine years previously, had been attacked with chorea subsequent to a heavy and tedious labour. The head and the upper extremities were the chief seat of the spasmodic movements;

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[1] Jos. Frank; Praxeos Medic. Univ. Præcepta: Lipsiæ, 1841, vol. i, p. 348.

the lower were also affected, but in a less degree. The patient had a tortuous gait; the trunk was twisted as if she were dancing; and she was therefore looked upon as inebriated when walking in the streets.

In boys the development of puberty, and the irritation resulting from onanism, have an undeniable influence in causing chorea. An anæmic constitution affords a frequent predisposition. The rheumatic predisposition noted by English medical men, was rarely traceable in the cases that have presented themselves to my observation. In one healthy girl of 9 years, a few weeks previously violent rheumatic pains had affected the joints of the extremities of the right side, and as they disappeared the choreic movements supervened. Some of my patients I found were influenced by atmospheric changes, thus, a girl of 24 years of age, who, from her fourth year, had been affected with chorea, chiefly of the left side of the body, was seized with violent lacerating pains in the extremities, suffering under the disease when a change of weather occurred, and she was always in much better health in the heat of summer than during winter. In another young female patient, who had been subject to chorea for six weeks, there were no painful sensations, but the movements were much aggravated as soon as the weather became wet and stormy. Among the patients treated by me at the hospital, there was a man of 34 years, who attributed the commencement of his chorea to the suppression of perspiration of the feet; this he restored by a domestic remedy common in Berlin, consisting in introducing the feet into a bag containing living ants with their eggs, while they are being roasted by a hot stone,—the result was that the chorea disappeared,[1] though he had a trifling relapse subsequently. Some medical men state that the second period of dentition favours the occurrence of chorea, and Gregory relates a case of chorea in a boy in whom the second set of teeth appeared before the first were shed; the removal of a considerable portion of the latter induced a cure, and the relapse, which occurred a year later, yielded on the extraction of the remainder.[1] Some writers have assumed direct irritation of the spinal cord and of its envelopes, as a cause. Thus Stiebel[2] considers swelling of the seventh cervical vertebra, with tenderness when touched with the finger, or when a hot sponge is passed over it, as a cause of chorea; he states that he has never failed to find this symptom. In the majority of a large number of cases which I have examined, I have been unable to discover such an alteration; and a comparison with healthy individuals has convinced me that no stress can be laid upon such a projection of the seventh cervical vertebra. Froriep was the first to draw attention to the tumefaction of the odontoid process. I have only once seen chorea result from an inflammatory affection of the spinal cord; it happened in a scrofulous boy of 13 years of age, who, in his fifth year, had suffered from a serious injury of the head, the cicatrix of which was still perceptible in the occipital region. There was violent fever, tenderness of the whole surface, most marked in the dorsal and cervical region, and increased by the slightest movement, constant supine position, incapability to stand, frequent desire to pass water, constipation, and delirium alternating with somnolency; these symptoms rendered powerful antiphlogistic treatment necessary, and this, especially the repeated local abstraction of blood from the head and along the vertebral column, had the desired effect within eight days. A week later convulsive movements of the mouth and the upper and lower extremities supervened, with insecurity in walking and standing, and mental excitement, which was manifested even at night by loud confused talking and restless dreams. After a few days the spasmodic movements were confined to the angle of the mouth and the extremities of the right side, and the loss of control of the spontaneous movements accompanying chorea, gave the boy that singular appearance which non-medical people often look upon as oddity or bad habit.

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[1] The suppression of perspiration of the feet is much less frequently a cause of convulsive than of paralytic affections. One of these rare cases occurred in the person of a nurse, of 40 years of age, belonging to the clinical wards; from her early life she had been affected with perspiration of the feet; when in January, 1848, it ceased in consequence of her getting wet, and she was attacked with spasm in the extensors of both feet. The attacks, during which the foot was drawn up to the leg, and the toes towards the back of the foot, occurred from eight to ten times daily, and disappeared as soon as the perspiration of the feet had been restored by footbaths containing potassa fusa.

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[1] Wicke; loc. cit., p. 319.

[2] Kleine Beiträge zur Heilwissenschaft; Frankfurt, a. M., 1823, p. 50.

Death rarely takes place in chorea from exhaustion resulting from the extreme consumption of motor power. Sometimes it is brought on by a complication with cerebral affections and other diseases. The anatomical examinations hitherto made have only yielded the negative fact of an absence of structural changes of the spinal cord which bear a definite relation to the disease. A few observations recorded in modern times may be appropriately introduced here. Hughes[1] relates the case of a man, aged 25, whose disease had begun with stiffness and twitchings of the hands, and more especially of the left. The movements extended to the arms and the face, his speech became laboured, and both feet participated in the affection. The movements became so intense that the patient was thrown out of his bed. They continued without intermission, day and night, depriving him of all rest. The exhaustion assumed a threatening character; the skin was bathed in perspiration, the features sunk, the pulse small, while consciousness remained unimpaired. Tonic and excitant remedies were unavailing. A half-grain dose of acetate of morphia produced no effect; and on administering a second dose, consisting of one grain of opium, the symptoms subsided for ten minutes, but were followed by a fresh outbreak of the movements, during which death overtook the patient, six weeks after the appearance of the disease. On opening the cavity of the skull, thirty-one hours after death, a small quantity of blood was found upon the arachnoid, in the vicinity of the vertex, but it was doubtful whether it had not been effused in consequence of the force used in removing the skull. The right margin of the fornix was much softened; the surface of the third ventricle was swollen, red, and softened. The spinal fluid was opaque, of a yellow colour, and very coagulable with heat. The spinal cord appeared less consistent than normal. There were traces of a slight attack of pleurisy, and pneumonia, and some ecchymoses on the visceral layer of the pericardium and endocardium. The lining membrane of the aorta was saturated with fluid blood, and covered with atheromatous deposit in the vicinity of the heart. The semi-lunar valves were thickened; on one there was an opaque granular deposit, while the other two were adherent, though it could not be determined whether in consequence of a congenital or pathological process. Some red striæ were observed on the peritoneum, as of incipient inflammation. Bright[1] has communicated another instance. A girl, aged 17, was attacked a second time by chorea, with extreme intensity. Death followed, with typhous symptoms. On section, considerable congestion of the cerebrum was found, and about five or six small osseous lamellæ at the pia mater of the lower portion of the spinal cord, which was perfectly normal in all other respects; the right ovary contained a cyst of the size of a hazle nut, filled with red viscid matter, and semi-transparent; osseous concretions were found attached to the fimbriated extremity of the right Fallopian tube, looking like large grains of sand, and of irregular shape. Similar concretions were seated upon the external surface of the broad ligament. We owe the following interesting account to Froriep:[2]—Augustus S—, aged 10 years, had been affected for a twelvemonth with spasmodic movements of the voluntary muscles, which often remitted so as to leave free intervals, but resisted all medication. The boy was admitted into the Hôpital la Charité, in Berlin, on the 8th of July, 1834. The movements presented a most perfect picture of chorea, and affected all the voluntary muscles, the upper extremities and the face being most violently agitated. It was necessary to employ bodily restraint in order to prevent the patient from injuring himself. He constantly moved his head from one side to another, and his face presented constant jerkings and distortions. The latter was crimson, and there were all the symptoms of violent congestion to the head. His consciousness continued unembarrassed. Even during the night the twitchings scarcely ceased; the patient was almost constantly moving during his sleep, and, after a short, restless slumber, he was again woke up by fresh attacks of violent spasms. Deglutition was very difficult, and there was obstinate constipation. On the 13th of July, after a night of uninterrupted convulsions, which successively increased in violence, death ensued from apoplexy. On making the *post-mortem* examination, the larger veins on the surface of the brain, as well as the vessels of the cerebral substance, were found gorged with blood. The cerebrum and cerebellum, as well as the pons varolii, were normal. A shallow impression, resembling a fossa, was found at the lower anterior surface of the medulla oblongata, as if the little finger had been pressed against it. The membranes of the part were opaque, and thickened laterally. Corresponding to this impression, a remarkable alteration was found at the foramen magnum of the occipital bone; it no longer offered the usual transversely oval opening, but presented the shape of a bean, with the hilus directed forwards. On further investigation, it was found that the change of shape depended solely upon a tumefaction of the odontoid process. This process of bone was of the same size and thickness as in an adult man, but merely contained a peculiarly spongy and rather dense tissue, without actual degeneration. The bones of the occiput of the atlas, and the body and arch of the second vertebra, appeared, so far as could be seen, to be perfectly normal. Cruveilhier[1] gives the following report of a case of chorea combined with a paralytic affection:—The patient, a female of fifty-four years of age, complained seventeen years before her death of a numbness in the left, and subsequently in the right, leg. Her gait became irregular. After a time the upper extremities also became involved. During the last three years (previous to coming under observation) the condition of the patient remained the same. Her speech was impeded and interrupted, and even the utterance of a few words was accompanied by grimaces like those of chorea, and the more she attempted to repress them the more violent they became. The lower extremities were much emaciated, the feet extended, and the toes bent; it was necessary to use force to restrain the limbs, as they were otherwise thrown into violent and irregular movements, so as to resemble the fantastic contortions of the puppet whose arms and legs move by drawing a thread. The same phenomena occurred when the patient was required to move her legs spontaneously; she then requested the bystanders to remove to a certain distance, as the slightest effort of the will caused violent jerks and leaps, which she was no longer able to control, and they could only be arrested by mechanical interference. The arms were rather more obedient; she was able to convey solid food to the mouth without difficulty, but she spilt liquids, which therefore had to be given her like a child, with a spoon. Every voluntary movement demanded on her part a preparation, a mental effort. She feared the days on which she was subjected to the examination of the physicians, as she felt the fatigue and excitement consequent upon it for four and twenty hours after. The voice and respiration were weak; she was scarcely sensible to pinching or pricking. She could feel large objects when she had grasped them, but in order to seize and hold small objects she was obliged to look at them. Her intellect was clear. At the cadaveric examination Cruveilhier found an hortensia-coloured softening in the lower occipital convolutions of the left cerebral hemisphere; the spinal arachnoid was opaque and thickened, and more adherent than normally. The spinal cord was atrophied, being reduced by one third of its normal size; the middle and posterior columns were converted throughout into a firm band of grey or greyish yellow colour, which above passed into the restiform bodies, the white layer of which is formed by the lateral columns of the spinal cord. The degeneration extended up to a level with the cerebellum. On making a transverse section of the spinal cord, it was evident that the disease was exactly confined to the middle posterior columns. The posterior roots of the spinal cord were entirely atrophied, transparent and filiform; they offered a strong contrast to the anterior roots which were unchanged. This atrophy was less in the cervical than in the dorsal and lumbar regions.

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[1] Guy's Hospital Reports, 1846, p. 390.

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[1] Reports of Medical Cases, p. 489.

[2] Neue Notizen aus dem Gebiete der Natur und Heilkunde, No. 224, p. 7.

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[1] Anatomie Pathologique, livr. xxxii, p. 19.

I have myself had three opportunities of examining patients who had died of chorea, but in one only could the vertebral column be opened.

An unmarried female of 76 years of age, had been affected with chorea from her sixth year. Her intellectual powers remained undisturbed until the last year of her life, when she became affected with senile imbecility. Her speech was indistinct and laborious during her whole life. The associated groups of spasmodic movements of the extremities, and especially of the arms, were as characteristic after seventy years' duration as in a recent case. The muscles of the trunk were also affected, so that the body was often cast from one side to another. Both halves of the face were affected with histrionic spasm. The muscular power of the legs had much decreased of late years, whilst sensation continued unaltered. For a considerable period the patient had been troubled with pulmonary catarrh and emphysema. She died on the 15th February, 1841, in a state of asphyxia. The cerebrum was atrophied; the gyri were narrow and far apart; in the sulci and between the membranes on the surface, there was a considerable quantity of serous fluid; both crura cerebri were so much softened, that while removing the contents of the skull, the brain tore through at these points; they were of a brownish hue throughout, so that the contrast between the grey and white portions was not marked. The spinal cord was divided and removed as low down as possible; but no alteration in structure or consistency was discovered. On lowering the head but little fluid was discharged from the vertebral canal.

The second case occurred in a boy of 10 years, who was affected with chorea of so intense a character, as I had never seen it previously. Both sides of the body were the seat of the disease; by day the muscles of the face, the extremities, and the trunk were in a state of almost constant agitation, with but few remissions; the body was so violently convulsed, that the patient was cast from the sofa on the ground. No movement could be executed by the boy, whether spontaneously or at the suggestion of another person; his sleep was short and restless, so that even at night there was only a brief intermission. Articulation was much impeded, and, at last, it was even arrested altogether. Beyond obstinate constipation, there was no other derangement. I repeatedly instituted experiments on this boy, to ascertain whether irritation of the skin at different points, exerted any influence upon the character of the movements, but I was unable to discover any relation of the kind; even on tickling the volar and plantar surfaces, the movements were neither altered nor augmented. Other agents seemed equally inert as to any influence produced upon the progress and type of the malady. Cold affusion to the head and back was the only thing that increased the spasms. After a duration of four weeks, an inflammatory affection of the brain supervened. The violence of the movements remitted as soon as coma was manifested. The rapid and excessive emaciation of the patient was remarkable; it was particularly marked in the face, for the child's features assumed the character of senility as we see it in tabes mesenterica. During the twelve hours preceding death, the chorea entirely ceased. The post-mortem examination was made on the 16th of May, 1841. I found the brain very large in proportion to the size of the cranial cavity; on removing the skull-cap, it rose up as if it had been previously compressed. The superficial vascular injection was considerable. The arachnoid was dull, and covered with a quantity of plastic matter lying along the inner margin of the hemispheres. Owing to an accidental lesion, a quantity of clear serous fluid had escaped from the ventricle. The central parts of the brain, the fornix, the septum, and the walls of the lateral ventricle were softened so as to present a pulpy consistency. The corpora quadrigemina were so much softened as to be perfectly diffluent. The normal firmness of the remaining portions of the cerebrum and cerebellum presented a strong contrast to this condition. The medulla oblongata and spinal cord presented no abnormity so far as they could be examined.

The third case happened in a girl of 9 years of age, who for a few months previously had been labouring under a severe degree of chorea associated with movements of the facial muscles, of the head, the trunk, and especially the superior extremities. For three weeks past she had been suffering from a mucous diarrhœa. The belly was distended, tympanitic on percussion, and painful on deep pressure being applied in the cæcal region. This was the condition of the child when it was admitted into the children's wards in the Charité on the 19th of Nov., 1841.

The intensity of the chorea symptoms was not diminished, in spite of the diarrhœa continuing several times a day. Consciousness was unembarrassed, articulation impeded and unintelligible; the emaciation was marked. The skin rough, the tongue moist and clean. This complication induced me first to attend to the inflammatory affection of the intestinal mucous membrane, for which leeches, poultices, and mucilaginous drinks were ordered. The diarrhœa was relieved shortly. On the 22d of the month after a pultaceous motion, the abdomen, which continued tympanitic, presented so great a tenderness, that the very slightest pressure could not be borne. Fluctuation was distinctly perceptible in the abdominal cavity, and the feet were œdematous. These as well as the hands and tip of the nose were cold. The pulse was small and weak, and beat 120 times in the minute. There was much thirst. Eight leeches, fomentations of the abdomen with infusion of chamomile, calomel and digitalis āā gr. $\frac{1}{4}$, every two hours, were ordered. The peritonitis increased in intensity; while the chorea movements were much diminished. The face became distorted, the fæces and urine passed away involuntarily, the patient lay immovably on her back, and there was œdematous tumefaction of the lumbar region. Five drops of the oil of turpentine were ordered to be given every two hours in an emulsion, accompanied by terebinthinate frictions of the abdomen. On the 25th the belly was somewhat sunk, the quantity of the urine increased, but the tenderness continued the same. Every touch caused a weak scream which soon passed into a continuous low cry. The oil of turpentine, the external application of which had produced a slight erythematous redness, was continued. On the following day the distension and fluctuation were found to have increased, there was œdema of the legs and thighs, unconscious discharge of urine and liquid yellow excrements, short, oppressed respiration, and a dry hacking cough. On the 27th the death struggles commenced, and the fatal issue occurred the same evening. The cadaveric examination was made on the following day, and it proved that the brain was healthy, that there was slight softening of the dorsal and cervical portions of the spinal cord, while the lumbar portion presented a firm consistency. The peritoneal cavity contained a very considerable amount of dull, brownish-yellow fluid; the pelvic portion of the peritoneum was the seat of intense inflammation, and a large quantity of yellowish-green, thick pus was found in it between the bladder, the uterus, and rectum. The abdominal parietes and peritoneum presented nothing abnormal. In the small intestine adjoining the cæcum, there were patches of congestion and cicatrices of former ulcers. The cæcum and a portion of the ascending colon were intensely inflamed, the mucous membrane was swollen and eroded at several points. I regret that at the time these cases occurred to me I was unacquainted with Froriep's observation of the enlargement of the odontoid process; the point was therefore not attended to.

The *prognosis* of chorea, is, on the whole, favorable, it is to be remembered that there is a tendency to one or more relapses, at longer or shorter intervals after the first attack; thus, in a girl, a clinical out-patient of nine years, five relapses took place with a tolerably uniform interval of one year. When the malady is very intense, it occasionally leaves a few convulsive grimaces and gesticulations, which continue throughout life. Some writers assert that it induces idiocy, but I have not myself met with a case corroborative of the statement.

Chorea occasionally gets well spontaneously, on the appearance of the catamenia, and in pregnant women after parturition. In recent cases therapeutic interference generally owes more to the vis medicatrix naturæ than we are quite willing to admit. This is proved by the fact that the disease very uniformly extends to four weeks and more, under the most various modes of treatment. We rarely succeed in cutting the disease short. Cases of this kind, which have come under my observation, affected young girls during the development of puberty, who were in a state of psychical and physical excitement. I have found derivation to the intestinal canal by the daily use of purgatives of very decided benefit. The removal of the cause, when feasible, is not necessarily followed by a cessation of the disease; at times, however, we may, by attending to this point, arrest the chorea. Thus, I saw a boy, aged 6 years, in whose fæces the mother not unfrequently discovered traces of ascarides; on the employment of calomel and jalap powders, which brought away a large quantity of the oxyuris vermicularis, the patient rapidly recovered. In pregnant females, in whom the intensity of the choreic spasms carries with it excessive exhaustion, even artificial abortion may be justified.

It would be useless to enumerate the various remedies recommended; those only are deserving of our confidence which are able to arrest the disease in a short space of time. The foremost among these, an experience of several years has taught me to be arsenic. I have already published some proofs of its efficacy in the 'Klinische Ergebuisse,' (1846.)

A girl of 11 years had been affected for eight years with intense chorea, especially of the right half of the body, the neck and cervical muscles being also much agitated. According to the mother's statement, the disease made its appearance after an attack of smallpox, and all the remedies applied for a series of years had proved ineffectual. On the 22d of November, 1842, Fowler's solution was ordered for the first time, but was omitted again for a time, when after a week slight toxic symptoms were manifested. It was then again given in increasing doses; a marked improvement was manifested at the end of January, 1843, and in March the patient had entirely recovered from the chorea of eight years' duration; she continued free from it, as she assured me on applying for relief in 1849 for a paralytic affection of the face, caused by rheumatism. In another patient, a girl of 10 years, the chorea, which had been brought on by a sudden fright, had continued for two years. Purgatives, preparations of iron, and cold affusion of the head and back, had been employed in vain by other medical men. Fowler's solution was ordered on the 29th of January, 1844; on the 19th of February the symptoms presented a marked abatement, and on the 5th of May the patient was discharged cured. In the spring of 1850 I was called to a case of chorea of extreme intensity in a foreign family, which had persisted for six months. The patient, a girl of 8 years, after a previous attack of articular rheumatism, had for half a year been affected with chorea, to such an extent that she could neither walk nor stand, nor speak articulately; when awake her violent movements rendered it necessary for several persons to hold her, and she was much emaciated. All the remedies tried had failed. The use of Fowler's solution continued for eight weeks, and taken in doses of four drops three times a day, established the cure. Arsenic does not prevent relapses of chorea; but I have found that they are more amenable to this powerful agent than even the first attack. The proper precautions being used, I have never seen the slightest evil result occur, even in children, from the use of arsenic; I do not order more than from three to four drops three times a day, and I dilute them with treble the quantity of distilled water. A trifling inflammation of the conjunctiva is the first symptom of the poisonous effects of the remedy, which demands that it should be set aside for a few days.

Many powerful voices have been raised in favour of iron, and there can be no doubt that it is very efficacious in anæmic constitutions. Different authors have spoken in favour of different preparations. German physicians prefer the hydrocyanate of iron in doses of from three to eight grains, according to the age of the patient. English physicians are in favour of the carbonate of iron, given in large doses. The latter, also, recommend the sulphate of zinc in increasing doses, up to half a scruple and more; it has not merited such praise in the cases that have fallen under my observation. Among the baths Baudelocque affects those prepared with the sulphuret of potash (four ounces to sixteen pails of water), and their efficacy has been tested in the Parisian hospital for children. The average duration of treatment was twenty-four days, whereas it is commonly thirty-one days.[1] Ordinary electricity and electro-magnetism are likewise to be recommended.[2] When we employ the latter, the best plan is to draw sparks from the spine. In 35 out of 36 cases treated in this manner, a cure or considerable amelioration was effected in a brief space of time. The diet should not be too sparing and lowering; even a moderate use of wine is found to be beneficial. Fatigue, especially of a mental kind, is injurious. It is necessary that the patient should reside in a pure atmosphere. Sea-baths are suitable for after-treatment.

Besides the chorea which is connected with the period of development of the second dentition and puberty, and with pregnancy, there is a morbid condition, which, in addition to other symptoms, often displays the characteristic movements of chorea. We allude to mercurial tremor, which we shall examine more in detail in the sequel. But even if there be no tremor, the peculiar relation of the choreic movements to the voluntary movements, is occasionally exhibited in mercurial poisoning. To mention a single instance, Travers[3] gives the history of a looking-glass maker, who was not affected with the ordinary symptoms of tremor, but with sudden spasmodic movements of the limbs whenever he attempted a voluntary movement. The patient was able to sit quietly on his chair, but when he rose up and attempted to walk in a definite direction, his legs became so violently and rapidly agitated against his will, that he was almost thrown down. The upper extremities behaved in the same way; he was, therefore, unable to carry a glass to his mouth. His speech was also indistinct. Mental excitement or embarrassment very much increased the spasmodic movement, so that even examining the pulse, if the patient's attention was directed to it, gave rise to great subsultus tendinum.

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[1] Rufz; loc. cit., p. 106.

[2] See—Guy's Hospital Reports, 1841, vol. vi, p. 87.

[3] Travers; A further Inquiry concerning Constitutional Irritation and the Pathology of the Nervous System; London, 1835, p. 399.

CHAPTER XXIII.

SPASMS DEPENDENT UPON THE SPINAL CORD AS A CENTRAL APPARATUS.

The reflex power inherent in the spinal cord as a central organ of the nervous system, when abnormally exalted, is the source of spasms which till recently were imperfectly understood, as their physiological basis was unknown.

SPASMS ARISING FROM INCREASED REFLEX EXCITABILITY.

Experiments upon animals shew that reflex movements depend not only upon the kind, the seat and the intensity of the irritant applied, but also upon the condition of the reflex excitability. At the commencement of the experiment the slightest sound induces movements, but the longer it lasts the more powerful stimuli are required. After a pause the weaker stimuli may again suffice to produce the phenomena. The less the excitability, the more limited will be the movements, provided the intensity of the stimuli continues the same. Thus, when a considerable time has elapsed after the decapitation of an animal, we are no longer able by irritating a limb to excite movements in other parts besides the one irritated.[1] The younger the animal the greater its reflex irritability, a function which is also more developed in spring and autumn than in summer or winter. The loss of cerebral conduction exerts a great influence upon the increase of the power. After decapitation even those stimuli produce reflex action, which did not do so previously.[2] Lastly, there are certain substances which increase the reflex excitability; strychnine and opium belong to this class. A lesion of the spinal cord after decapitation also increases the susceptibility to reflex stimuli.

In man we find similar conditions to hold good with regard to the increase of reflex action as in animals. When the cerebral impulse is interrupted, and the conduction of the will arrested, the reflex phenomena not only become more evident, but they also break forth with greater force. We recommend our readers to consult the observations illustrative of this point collected by Marshall Hall[1] and Budd.[2] We quote the following case from the writings of the latter, as particularly instructive:—

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[1] Volkmann; über Reflexbewegungen, in Müller's Archiv, &c., 1838, p. 23.

[2] Volkmann; loc. cit., p. 32.

A man, aged 27, had become paraplegic after an injury of the lower cervical vertebræ. The sensibility of the paralysed parts was much diminished, especially in the feet; the motor power returned to the hands on the thirtieth, and to the feet on the sixty-ninth day. During the first week tickling the sole of the foot only induced trifling movements of the foot, and not even invariably; on the ninth day, the movements became more vivid, and up to the twenty-sixth they increased in extent and intensity. At first the tickling of one sole merely induced movements in the corresponding foot, subsequently of both feet, and on the twenty-sixth day, not only of the lower extremities but also of the trunk and the arms. Tickling the left sole, on which the epidermis was raised by a blister, produced more violent and extensive twitchings than when the right sole was tickled. From the twenty-sixth to the twenty-ninth days, the reflex movements were excited by the following causes: in the lower extremities they were induced by the passage of flatus through the intestines, or by touching the penis with the cold urinal; pulling out a hair from the mons veneris gave rise to convulsions of the upper extremities, and of the trunk. On the forty-first day a hot metal plate was applied to the sole of the foot, and excited more violent movements than any stimuli previously used; they lasted while the plate was held to the foot, but although it drew a blister, the patient was perfectly insensible to it. A plate of the ordinary temperature gave rise to no movements after the first contact. Ice applied to the soles did not induce any more violent movements than a body of the ordinary temperature. Pricking the legs, or plucking hairs from them, exerted the same influence as titillation. The introduction of the catheter gave rise to convulsions of the trunk and the members. These also occurred during and after an evacuation from the bowels. (In the other patients the reflex movements and twitchings were also most violent during defecation and micturition.) There was a frequent outbreak of convulsions in the muscles of the legs, arms and the trunk, without any external exciting cause. As soon as the cerebral conducting power began to return, the patient was enabled in a measure to control the reflex movements, but only at the expense of a powerful effort of the will. The first attempts made by the patient to walk had a remarkable appearance, as the tendency to involuntary movements continued, and even in standing the knees at first bent forcibly. On the ninety-fifth day this symptom manifested itself as soon as the individual had walked a few steps. The legs then began to bend upwards; this the patient counteracted by rubbing his stomach, upon which his feet became extended by jerks. On the one hundred and forty-first day he was able to walk by resting against a chair, and pushing it forwards, yet his gait was tottering, and resembled that of a chorea patient.

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[1] On the Diseases and Derangements of the Nervous System; London, 1841, pp. 230—239.

[2] Contributions to the Pathology of the Spinal Cord, in Medico-Chirurg. Transac., vol. xxii, p. 153.

We find that the reflex excitability of man may, even while the cerebral conduction continues unimpaired, be exalted by causes acting either by means of the blood, or by irritation of the spinal cord, or of peripheral nerves of sensation. We reckon among the former two poisons, one belonging to the vegetable kingdom, the alkaloid strychnine; the other of an animal origin, the poison of hydrophobia. Among the latter we have to notice traumatic irritation, sexual and rheumatic irritation, &c. Organic diseases of the spinal cord may also be accompanied by an exaltation of the reflex function, as demonstrated by the following instructive case given by Hutin.[1]

"J. V., æt. 31, was admitted into the hospital of Bicètre in 1819, when he presented the following symptoms: the sense of touch was generally exalted to such an extent, that on applying the tips of the fingers to any part of the body, a peculiar painful tremor, and corresponding muscular contractions, were perceived, resembling those produced by an electric discharge. If in assisting him in the ordinary wants of life, for instance, in changing his linen, the body was touched or moved, the patient was seized with universal epileptic convulsions, his limbs became rigid and contracted, he coiled himself up as it were, the eyes rolled about in their sockets, and his face was frightfully distorted. The pulse was frequent, small, and hard; respiration slow and profound, the appetite tolerably strong, and the organic functions were regular. The gait of the young man was very peculiar; he was constantly jumping, and he did it in the most singular manner; he feared to put his feet to the ground, on account of the painful impression it caused, and which almost overcame him. There was an excessive restlessness in his movements, yet his muscles developed no power. During the last fortnight of his life, a violent diarrhœa, and an almost constant vomiting supervened. The partial and general convulsions were excited by the most trivial causes; his sensibility was in a state of such extreme exaltation, that the contact of the bed coverings or articles of dress was painful; the excitement did not allow him a moment's rest. The patient died at last in the most terrific convulsions, prostrated and exhausted. *Sectio cadaveris:* The cerebellum was visibly atrophied; its medullary centre, as compared with that of another subject, was a third less in size in either hemisphere. The white substance, which in the normal condition occupies the centre of the corpus rhomboidale, had ceased to exist, so that the fimbriated margins of this portion approached the centre, and only formed a small pyriform, very hard, grayish-brown body. The spinal cord, from the foramen magnum to the dorsal region, was hypertrophied to such an extent, as entirely to fill out the cavity of the dura mater; it was enlarged in the remainder of its extent, but in a less marked degree. Its tissue was very dense, and closely resembled fresh stilton cheese; its inferior portion was less indurated, though more dense than in health, for its consistency was fully equal to that of the pons Varolii. The inner surface of the arachnoid was almost throughout adherent to the cord; underneath it exhibited broad cartilaginous laminæ; the spinal nerves had not acquired a great increase of density; there were distinct symptoms of inflammation.

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[1] Untersuchungen und Beobachtungen zur Pathologie des Rückenmarkes, in Nasse's Sammlung zur Kenntniss der Gehirn-und Rückenmarks-Krankheiten. Stuttgart, 1837, 2 heft, p. 21.

mation of the mucous membranes in the stomach and the lower end of the small intestine."

Whatever the influence may be that increases the reflex excitability, and however the consequent spasmodic movements may vary, they have one feature in common, that the control exerted upon movements by the healthy brain is in subjection; this gives rise to peculiar psychical relations, and renders the spasmodic phenomena the more entirely dependent upon external stimuli. The feature characteristic of the disease, as an affection of a central nervous organ, consists in this, that all the nervous functions of the spinal cord are implicated; not only the motor, but also the sensory and nutritive energies of the cord are variously affected.

We shall, in the first instance, examine the reflex neurosis proceeding from sexual irritation, which is generally comprised under the comprehensive term—hysteria.

HYSTERIA.

The name indicates the sex which is most liable to suffer from the disease.

The general characters of the affection are: spasmodic movements in the muscles supplied by cerebro-spinal as well as by sympathetic fibres; hyperæsthesiæ, occurring in paroxysms which are easily excited, and vary much both as to time and seat; subjection of the mental powers to the domination of physical reflex action; irritable debility both of body and mind during the intervals; and dependence of the disease upon the condition of the sexual organs.

The attacks are not unfrequently heralded by precursory symptoms; the most frequent are debility, altered spirits, a painful sense of restlessness in the legs, repeated desire to make water, a sense of pressure and constriction at the pit of the stomach and in the throat. The paroxysm, however, often breaks out suddenly, with symptoms that are confined to single nervous foci, or affect the body more generally. The former groups most frequently form in the range of the vagus and the respiratory nerves generally, which are more or less involved in all hysterical complaints; to this class belong the spasm of the glottis, the bronchi, or the pharynx, accompanied by dyspnœa, or threatening suffocation (strangulatio hysterica), by a sensation of a ball ascending from the chest to the throat (globus hystericus), and a short, frequent, sonorous cough with a metallic sound, spasmodic screaming, laughing, or crying, and paroxysms of yawning or hiccup. Next in order we find the cardiac nerves to be the seat of the affection, evidenced by sudden attacks of palpitation, with irregular, deranged rhythm, and a sense of anxiety. The spasm also frequently affects the hypogastric plexus, especially the nerves of the bladder; the patient suffers from ischuria and dysuria. If the disease extends, the reflex action involves the muscles that receive their impulse from the cerebro-spinal nerves; we then meet with tonic and clonic spasms, affecting the limbs of one or both sides, the muscles of the back, thorax, and abdomen, in various forms and degrees, from mere tremor and agitation, to the most convulsive movements and contortions. The masticatory and histrionic muscles of the face take part; trismus, chattering of the teeth as in the rigor of fever, the sardonic laugh, and a rolling of the eyeballs upwards occur. Coincidently with the convulsions, there are hyperæsthesiæ in the same or in other parts, and generally of a neuralgic character; they affect the cutaneous surface of the head and face, the back (especially the cervical and dorsal vertebræ), the chest and abdomen (especially the ovarian region of one, or, less frequently, both sides), or the extremities; at times they are confined to a small space, are suddenly increased by superficial contact, but diminish on deeper pressure. A frequent concomitant is the development of gas in the intestinal canal, as well as the secretion of a colourless, limpid urine, containing merely the ordinary salts without urea or the organic constituents.

The paroxysms are liable to sudden transitions, both as to degree and seat; and it is not a less characteristic feature that the change is often one of striking contrast, excessive sensibility and mobility passing into obtuseness and immobility, amounting even to paralysis,[1] or profuse secretion alternating with suppression of the discharge. Thus numbness of the hands, syncope, aphonia, and according to the observations of older authors, even asphyxia associate themselves with hysterical attacks. After a duration varying from ten minutes to several hours, the paroxysm often terminates suddenly with a flow of tears or a copious discharge of urine, but not unfrequently it passes off gradually. The course of the sun exerts some influence upon the paroxysms of hysterical patients, the morning excites while the evening calms them.

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[1] See the remarks on Reflex Paralysis dependent upon Affections of the Sexual Organs, at a subsequent part of this volume.

During the intervals of the paroxysms, the hysterical character of the complaint is indisputably established, and it is these features which support the physiological rationale of the disease. In the first instance, we must take into consideration the increase of reflex irritation which is manifested on the application of stimuli. The extremest case that I have met with, occurred in a trichomatous patient; a Polish female of 28 years, who was early attacked with hysteria; the trichoma which formed in lieu of a critical discharge, had been twice cut off, and had caused an augmentation of the intensity and extent of the spasms; a slight touch of the skin was sufficient to produce the convulsive paroxysms instantly, much in the same manner as twitchings in a narcotised frog. I had scarcely applied my fingers to her wrist to examine her pulse, when her eyelids began to blink, the chest heaved violently, hiccup supervened, and the tongue rolled about in the mouth with a clacking noise. Sir Benjamin Brodie[1] communicates a few instances in which the pressure of a finger upon the sternum instantly caused convulsive paroxysms. Schützenberger,[2] by pressure upon a sensitive ovary, induced the whole series of hysterical symptoms. It is not necessary for this purpose that the impression itself should be painful, though a sudden stimulus appears to operate more energetically. Nor is it irritation of the skin alone, though peculiarly adapted to exciting reflex action, which produces such effects; they also result from other sources of irritation, *e. g.*, intestinal. I have repeatedly observed that even the act of defecation excites and increases the hysterical paroxysms; a fact that corresponds with the above-quoted observation of Budd. The reflex phenomena occurring in the organic sphere are of peculiar interest. A not unfrequent instance is presented in the production and discharge of flatus on touching and rubbing the cutaneous surface. Peter Frank,[1] in his masterly treatise on flatulency, relates, among several other cases, that of an hysterical girl, who distinctly felt, whenever she herself or any other person rubbed any part of the cutaneous coverings, that gas accumulated in the stomach, which was at once discharged with an explosive sound by the œsophagus; and Rudolphi[2] relates the case of a female of advanced age, who was at all times subject to flatulent eructations, but in whom they passed off uninterruptedly as soon as she pressed any part of her abdomen with the finger.

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[1] Lectures illustrative of certain Local Nervous Affections; London, 1837, p. 62.

[2] See his instructive Essay—Recherches Cliniques sur les causes Organiques et le Mécanisme de la production des Affections appelées Hystériques, in—Gazette Médicale de Paris, 1846, p. 749.

The point of most interest in hysteria after the increased reflex excitability, is the psychical condition of the patient. The main feature is indecision, even amounting to an entire loss of the power of resolution; there is consequently an absence of resistance to extraneous influences, the patient yields herself up to, and is overcome by bodily and mental impressions, such as we see in no other disease; there is, therefore, no attempt at concealing or suppressing the paroxysms. The hysterical motto "I cannot help it," appropriately expresses this condition. In every other respect the mind is free, provided the disease be uncomplicated; and never even, in the most violent paroxysms, is there a loss of consciousness and perception. Besides the psychical character which marks the disease, the peculiarities of the sex also come into play, and the natural vanity, coquetry, whimsicality, tendency to exaggeration, and deception, and gossiping communicativeness of the female become more prominent.

The other organic functions also present changes; the most important of these occur in the uterine system. Abnormal secretions and discharges, as well as derangements of the normal secretions, are frequent; there is leucorrhœa, and the catamenia are irregular and of bad colour. In many cases we find one ovary swollen,[3] and the exploration by the aid of the speculum has afforded instructive illustration of the presence of hyperæmia, inflammation and ulceration in the accessible portion of the uterus. We are now able to present to the eye, what previously the most sensitive finger could not discover in the dark. Among other derangements, we find the development of warmth much interfered with; the temperature is generally reduced or irregularly distributed; while the feet and hands are cold there is circumscribed heat or flushing of the face. The skin and the muscles often present a flabby, faded appearance. Brodie[1] directs attention to a peculiar relaxation of the joints in hysterical females, which is apt to give rise to subluxation. A tendency to hæmorrhages, hæmoptysis, and hæmatemesis often exists. The urinary secretion may be diminished, but it is generally increased, and accompanied by a frequent desire to micturate. Although little food is taken, and there is a special dislike to animal diet, it is not unusual to find the patients become corpulent. The thyroid gland not unfrequently becomes temporarily enlarged.

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[1] De curandis hominum morbis, lib. vi, De retentione, p. 50.

[2] Grundriss der Physiologie, vol. ii, p. 239.

[3] Schützenberger; loc. cit.

The irritable debility, both of body and mind, occurring during the remissions, is pathognomonic. Mild remedial agents often induce violent and unusual reaction. Much of what is called idiosyncrasy rests upon an hysterical foundation. The influence of sensual and mental impressions is nowhere so sudden and marked as in hysterical subjects. Great timidity and a tendency to be overcome by emotions generally prevails. Nothing is more injurious than debilitating influences, and the attacks at once commence when the powers are reduced below a certain level. This accounts for the proclivity of hysteria to mix itself up with other diseases, which has induced Baglivi to say that "when a disease fails to yield to the suitable remedies, and progresses in a manner different from its ordinary course, we must suspect some latent mental influence (occasionally we may apprehend the venereal disease), or if our patients are females we may assume an hysterical nidus;" this is probably going too far, yet we often have opportunities of convincing ourselves that hysteria causes some confusion by associating itself with other maladies, and especially when they are acute; the unwary will be apt to be led astray by the semblance of important and dangerous conditions. Many a nervous fever which has been suddenly arrested, many a reported case of pericarditis or peritonitis rapidly cured, has been nothing more than a complication of hysteria with a catarrhal or rheumatic fever, or the puerperal state.

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[1] Loc. cit., p. 71.

If it be of importance to recognise hysteria when supervening upon other diseases, it is equally so to recognise the diseases complicating hysteria, in order duly to estimate the features foreign to hysteria; for people are only too ready to attribute all accessory phenomena to the hysteria itself. Psychical conditions form the most frequent complications, and among these most particularly monomania and ecstasis, the attacks of which combine or alternate with hysterical convulsions and hyperæsthesiæ. We less frequently meet with conditions of abolished or interrupted consciousness, syncope, morbus attonitus (see the section on Logoneurosis[1]), or epilepsy, which, in such a case, assumes an hysterical shading. Diseases of other organs may also combine with hysteria, and, a point not to be overlooked, may be for a long time masked by the symptoms of the latter. This occurs most frequently in pulmonary phthisis and disease of the heart, less so in phthisis intestinalis.

Etiology.—The condition for the origin of hysteria is the sexual maturity of the female; whether at its first development, during its persistence or at its cessation, especially if premature. The age of the individual exerts no influence in the matter, for in the tropics and certain countries of Europe, *e. g.*, Poland, where puberty generally occurs at an early period, a girl of 12 years may be hysterical. There is no doubt of the existence of an hereditary predisposition, and that it may be acquired by a luxurious and indolent mode of life. Debilitating influences are the most fertile sources of hysteria; among these we must mention over-excitement, or discharges, especially of the sexual organs, self-indulgence, imperfect coition, repeated miscarriages, a rapid succession of pregnancies and lactations, leucorrhœa, and menorrhagia. Abstinence from sexual intercourse, especially if previously indulged in, scanty and suppressed menstruation, may also frequently act as causes. Among the reducing causes we must also mention unnecessary or excessive abstraction of blood. The character of the blood, especially the anæmic state, exercises a powerful influence; the best proof of this is given in the hysteria accompanying chlorosis, and by the salutary result obtained by ameliorating the condition of the blood by chalybeates. Other morbid processes, especially the trichomatous constitution, favour the production and the development of hysteria. The foremost among the psychical influences is an erroneous system of education; whether it be lax and frivolous, allowing an uncontrolled play of every impression, or despotic, so as to interfere with every independent manifestation. The example of an hysterical mother developes the disease in the daughters. The emotions most prone to excite it are sentimental love, jealousy, and disappointed vanity. Among the accidental causes, those predominate which cause bodily and mental ennui; permanent and extended position of single limbs or the entire trunk, in consequence of fractures or luxations, or in orthopœdic institutions, tedious manual occupations, knitting, sewing, &c., solitude, absence of the usual amusements, emotions, atmospheric changes, especially intense heat, electric tension and storms, are very apt to excite paroxysms; nor are errors of digestion less influential.

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[1] [Dr. Romberg has not yet published this part.]—Ed.

Nosology and Diagnosis.—The theories of the disease which have prevailed for centuries, may be divided into two heads; hysteria is referred by one class of writers to the uterine system, and by the other to an affection of the brain. The advocates of either theory employ the arguments taken from the system that prevails at the time; thus, we meet with a series of suppositions and hypotheses, from the rising and wandering of the uterus or its vapours, to the assumption of metritis; from the confusion of the animal spirits, to the conflict of the passions. Let the present generation look into this mirror of the past, and be careful not to believe in the indestructible character of its own views. The reflex theory which is now gaining ground unduly, will have to be confined within its proper limits; we must therefore exercise all the more care in our inquiries. The fact that hysteria originates during the period of sexual maturity, demonstrates the dependence of the disease upon a certain condition of the sexual system; but it is necessary to guard against treating the latter as consisting only of one organ, the uterus, and we must take it in its totality, as frequent experiments upon animals, by excising the ovaries, and a few observations in the human species, have shown that the ovaries exert a more marked influence upon the organisation and the desires, than the uterus.[1] Even within the range of healthy action, this system is a source of stimulation of the nervous apparatus which is manifested in the most varied ways; we need only refer in evidence to the psychical alterations and reflex phenomena, the derangements of the circulation and the secretions occurring during the catamenia, pregnancy, and the puerperal state. These hygienic uterine stimuli also present a point of great interest, which may be employed to form a correct judgment of hysteria; we allude to the frequent absence of local sensations in spite of the existence of violent and repeated stimulation. Some have used this as an argument against the sexual origin of the disease, but independently of the not unfrequent sensations referred by hysterical females to the hypogastric region, we must remember that there is no necessity for sensations to become a matter of consciousness in order to produce reflex phenomena; it even appears that pain prevents the development of the latter, in the same way as gentle contact of the skin in narcotised animals produces movements more easily and more violently than laceration and pinching. Direct experiment also confirms these views; pressure exerted upon the ovarian region, which may be quite free from tenderness or touching the ulcerated points of the os uteri, which are often painless in themselves, may at once give rise to the entire series of hysterical phenomena. It was only very recently that I saw attempts made to replace a tumid uterus which had got wedged under the promontorium, followed by instant and most violent respiratory spasms. Irritation of the uterine system, which is manifested often enough by abnormal processes of nutrition, such as menorrhagia, leucorrhœa, retarded or increased catamenia, or amenorrhœa, operates like traumatic irritation, by the agency of the sensory, or if the expression be preferred, the centripetal nerves, upon the spinal cord; the reflex excitability of this organ is thus periodically exalted and diminished, and we possess the most indubitable evidence of this both during the paroxysms, as well as during the intervals. This is the element in hysteria by which to distinguish it from those spasmodic states, which certainly are induced by reflex action, but are manifested during the ordinary condition of the reflex excitability, the normal relation of the nervous function being restored after the spasm has passed off; numerous instances have been given of this, among the affections in which the motor nerves act as conductors; whereas, in hysteria, the exaltation of the reflex function effects and maintains a change in the entire habit of the individual, a delineation of which, though imperfect, we have attempted above. From the time when hysteria has taken root, the reflex action preponderates throughout the organism, and renders the individual more dependent upon external stimuli. It dominates over the moral energies of the patient, hence the incapability of resistance, the weakness of the will in characterising the disease. This psychical relation has been misinterpreted, and some have gone so far as to look upon the spasmodic laughing and weeping as evidences of prevailing affections of the mind; forgetting that, as in paralysis, sadness or joy may reside under the immoveable features; there may, on the other hand, be an histrionic expression of a mental affection and emotion caused by reflex action, without the presence of a psychical motive; the excitation of laughing by titillation is an everyday illustration of this fact.

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[1] See—Laycock; A Treatise on the Nervous Diseases of Women; London, 1840, p. 11.

Viewed in this light, hysteria receives not only a nosological, but also a diagnostic definition, by which it may be distinguished from other diseases, and especially from hypochondriasis, insanity, and epilepsy. In regard to the first of these affections, we refer the reader to the features described in the first part of this work (vol. I, p. 185); and we merely point out, that in hypochondriasis the mind excites and maintains the disease, while in hysterical subjects the disease undermines the mental powers. Hysteria is distinguished from insanity by the fact, that in all acts of intellect, subjectivity (the ego) is the ruling genius; self-consciousness is never alienated in the sensations, impressions, and desires, as is the case in erotomania, nymphomania, or in the complication of insanity and hysteria. Lastly, the fits of epilepsy are invariably accompanied by unconsciousness and anæsthesia; whereas, in hysteria, the perceptive powers are not placed in abeyance even during the most violent attacks; a powerful stimulus continues to make an impression upon the nerves of sense and sensation, and increases the spasms; an hysterical patient even during the fit starts when a loud noise is made, and closes her eyes under a brilliant ray of light. The difference is as plainly marked during the intervals; in hysteria we see the evidence of exalted reflex irritability, in epilepsy the expression of psychical depression, obtuseness and weakness of the memory, and in many idiocy, which is never the termination of uncomplicated hysteria, occurs in the course of the disease.

Course and Termination.—The disease, viewed in its totality, generally runs a chronic course, with gradual development, increase and remission of the symptoms, which, at the commencement of the affection, are not unfrequently associated with the catamenial period. Occasionally, however, and especially when hysteria accompanies the development of puberty, the outbreak is sudden and the course rapid. Hysteria does not itself prove fatal; it is only in the ancient authors that we find fatal syncope and asphyxia spoken of as occurring in its course. When death ensues by the supervention of some other disease, the most careful examination fails to detect any manifest alterations in the nervous tissues.[1] Even the danger of other affections is lessened in an hysterical constitution, and this applies not only to nervous phenomena, to symptoms of collapse and immobility, aphonia, ischuria, disturbed and suppressed secretions, tympanitis, &c., but even in dangerous diseases, occurring in hysterical subjects, we must not apply the same standard as in other individuals. It sometimes happens that hysteria passes into other neuroses, as insanity, epilepsy and ecstacy. A transition to chronic inflammation and disorganisation of the parts, which are the seat of the hysterical phenomena (the larynx, the pharynx, in globus hystericus; the bronchi and the pulmonary parenchyma in asthma,) has been spoken of by writers, but we have no guarantee for the accuracy of their observations; and more particularly we are left without that confirmation which the physical method of exploration alone can give, and which, in many cases, may lead us early to the discovery of the changes which were masked by hysteria. A complete recovery rarely takes place before the period of decrepitude; it may cease gradually by resolution (lysis) without distinct crises, unless complicated with other morbid processes, such as trichoma or impetigo, which are removed by the discharges peculiar to them. A pause often takes place in hysteria during pregnancy.

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[1] See—A few Observations by Sir B. Brodie, loc. cit., pp. 67—69.

Treatment.—The medical man who undertakes the treatment of hysteria must be prepared to exhibit patience, sympathy and firmness. When the moral energy is so suppressed, as it is in this disease, the mere manifestation of a determined will in another produces an imposing effect; still this influence must be exerted considerately and cautiously, and we must be yielding in trifles in order to carry out the plan of treatment with the more rigour and perseverance. On the other hand, we must be on our guard against simulation. Mulieri et ne mortuæ quidem credendum est, applies more especially to hysterical females. It may not be of importance in a medicolegal point of view to determine the existence of deception, as it is in epilepsy, but the patient should never be allowed to attempt a mystification of the physician, without severe reprehension. The criteria which must determine our judgment are the absence of increased reflex excitability, the absence of cold feet and hands during the paroxysms, and of the spasmodic small pulse, the limpid urine, and of the changeability and rapid transition of the phenomena.

The principle upon which our treatment must be based, is the removal of the main condition of the disease, the exalted state of the reflex functions. We possess three different means of doing this: 1st, by removing the reflex irritation, the chief focus of which is the uterus; 2dly, by influencing the reflex function itself; 3dly, by exciting and invigorating the powers of the will.

The first indication presupposes a careful local examination, without which the treatment of hysteria ought no longer to be commenced. In the 'Klinische Ergebnisse' I have already pointed out the value of this exploration, and have communicated a few cases, of which I shall quote the following:—A lady, aged 33, irregularly menstruated, and of a very anæmic habit, was subject to frequent convulsions of the trunk and extremities, during which she generally fell to the ground, but without being deprived of consciousness. The attacks which were announced by an aura mounting from the abdomen to the neck, frequently left tumefactions of different parts of the skin, which soon disappeared. During the intervals she was most variously affected, the symptoms chiefly residing in the range of the respiratory nerves; she suffered from globus hystericus, spasmodic laughing, crying and screaming, spasmodic cough, hiccup, occasionally aphonia and palpitations; her hands and feet were generally cold, and their sensibility obtuse. A very urgent desire to micturate and to evacuate the bowels, the act itself being accompanied with much pain, induced an exploration, from which it resulted that there was fluor albus and anteversion of the uterus, which occupied a lower position than usual. The cervix was swollen and somewhat painful. The patient was recommended to remain in the recumbent position; injections of an infusion of rue were made into the vagina, hip-baths, with an addition of sabina and chamomiles, and the internal use of the mineral waters of Franzensbrunn were ordered. After a few months, the patient was so far recovered, that nothing but the spasmodic action of the respiratory muscles remained. The local treatment of hysteria was the main feature in the therapeutic proceeding of the physicians of the past; but their mode of procedure does not deserve to be imitated, and we agree with Sennertus, who says naively of titillation of the cervix uteri: "frictio ista a christiano medico suadenda non videtur." The speculum has, however, afforded a new basis for the method, and the advances already made and to be anticipated from its aid, can only be compared with the discovery of Laennec; in spite of petty impediments, it will necessarily achieve a victory in the end. In hyperæmia and tumefaction local abstraction of blood is to be advised; from three to six leeches may be applied to the collum uteri, repeated once or twice during the interval of the catamenia, or immediately before or after the menstrual period, if we find it giving rise to an increase of the congestive state. We must, however, avoid letting blood too frequently or too copiously, because in the same degree as the forces sink below the normal standard, the hysterical symptoms will be augmented. Next in order, vaginal injections and hip-baths, first of tepid and subsequently of cold water, are to be employed. If there be excoriations or ulcers at the os uteri and its vicinity, cauterisation with lunar caustic in solution, or in substance, is required; it should be repeated on the fifth and sixth day, and be repeated until a cure is effected. The ulceration not unfrequently extends into the interior of the cervix and must be attacked in the same way; it is interesting to observe, that at the instant of applying the caustic, pain is much less frequently excited at the spot itself, than sympathetic sensation in the ovarian region, especially of the left side, in the sacrum and in one leg; spasmodic attacks in the region of the respiratory nerves are also frequently induced. When lunar caustic does not suffice, the application of the solution of nitrate of mercury, or of potassa fusa becomes requisite; this has also been found efficient in inflammatory induration and hypertrophy of the collum uteri without ulceration.[1] A low position and retroversion of the uterus are not unfrequently dependent upon an inflammatory tumefaction, and are to be combated by the same remedies; whereas, mechanical contrivances, such as pessaries, bandages, and the like, keep up and augment the local irritation and the reflex action upon the cerebral nervous apparatus. Coition produces the same effect, and should therefore be strictly interdicted.

I am the more impressed with the duty of directing attention to the morbid appearances of the uterus, and to the treatment to be based upon it, as I have had frequent opportunities, both in my own practice, and in that of my old friend, Dr. Mayer, who has afforded me the benefit of his extensive experience in obstetrics, of convincing myself of its advantages; while, on the other hand, I have seen numerous instances demonstrating the futility of all remedies while this focus of hysteria, if existing, is overlooked. But we must not expect to find such alterations in all hysterical patients. The question, therefore, suggests itself, whether, notwithstanding, we are justified in applying any remedial agents to the sexual organs as the sources of the reflected irritation. The older physicians recommended injections and suppositories for the vagina, prepared with medicines possessing an undoubted specific action upon the uterine nerves.

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[1] On these subjects, and on the mode of procedure, the reader may consult the instructive work of J. H. Bennet; A Practical Treatise on Inflammation of the Uterus and its Appendages, and on Ulceration and Induration of the Neck of the Uterus, 2d edit.; London, 1849, pp. 375—471.

℞. Gum. Asæfœtidæ, vel Galbani, vel Castorei, ʒiij;
Extract. Chamomill., ʒj.
Fiat massa, in partes tres dividenda. Formantur suppositoria tria, unguent. rosaceo oblinenda.

Injections of infusion of rue, valerian, or chamomiles, made in the recumbent position, so as to serve as local baths, were in favour with them. The use of hip-baths has, of late, become almost universal, though the fashionable use of cold water has been carried too far. I have obtained the most beneficial effects from the use of tepid hip-baths in cases of hysteria, in which sexual excitement, with voluptuous dreams, and the ejaculation of a mucous fluid, is followed by extreme prostration. We may, at all events, attempt the cauterisation of the interior of the neck of the uterus with nitrate of silver, the more so if it is accompanied by copious leucorrhœa.

The virgin state of the patients deserves an especial consideration. It is sufficiently known that hysteria not unfrequently occurs with the appearance of puberty, accompanied by painful and irregular menstruation, leucorrhœa, great debility, pains in the lumbar region, in the back, the ovarian region, the hips and lower extremities, and that it resists all the ordinary methods of treatment; the doctrine of spinal irritation, which derives its main arguments from this class of cases, has certainly not contributed to the advancement of therapeutics. Yet on the one hand the natural modesty, and, on the other, the fear of a laceration of the hymen, operate as powerful obstacles, and will continue to delay the employment of the approved local remedies. In many cases, Bennet[1] has found the vagina and hymen so much relaxed and yielding, that a small bivalvular speculum may be introduced without any laceration; but even if we are unable to do this, we should not place the trifling incision of this membrane in comparison with the responsibility we incur of neglecting the proper treatment, and allowing the years of puberty to become a period of misery and disease.

The second indication, which has for its object the quieting of the reflex irritability, is fulfilled indirectly by attending to and removing the disturbances in the relations existing between other organs and the nervous system, and directly by applying remedial operations to the spinal cord itself. As regards the first consideration, the blood deserves our most serious attention, both with reference to its constitution as to the relation it bears to the important sexual processes of evolution and decrepitude. The majority of practitioners have rather been inclined to assume a plethoric than an anæmic condition, although the latter predominates in hysterical patients, as is most clearly shown in the hysterical phenomena accompanying chlorosis. The time may not be far distant when the analysis of the blood itself will be required to establish a complete diagnosis; for the present the practitioner must content himself to draw his conclusions, *e juvantibus*, and according to the united opinion of the most trustworthy observers, we possess in the efficacy of iron, the strongest proof of the influence of the blood upon hysteria. A continued use of the various preparations, given so as to suit the peculiarities of the case, renders the blood a normal stimulus for the nervous system. The natural and artificial chalybeate waters for internal administration, and used as baths, are peculiarly appropriate. We must avoid overloading the stomach with large doses, especially of the tinctura ferri; and it is necessary to attend to the constipating effect of the remedy, which may be obviated by the use of Stahl's[1] aperient pills. (Dose from 1 to 3 taken at bedtime.)

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[1] Loc. cit., p. 168.

I have obtained permanent cures of inveterate hysteria by the prolonged use of the mineral waters of Spa and Pyrmont,[2] of which, even in winter, from one to two wine-glassfuls may be taken the first thing in the morning. If there be a plethoric habit, we should rather seek to restore the normal relation by dietetic and pharmaceutic measures, than by the abstraction of blood. Copious venesection is as little borne by hysterical subjects as other debilitating influences, and its injurious effects are often exhibited at once, though more frequently they are manifested after a lapse of time; small venesections are most likely to prove beneficial in plethoric individuals at the climacteric period. Milk-and whey-cures (serum[1] lactis tamarindinatum, &c.), the grape cure, the acids (sulphuric and phosphoric acid, the elixir acidum Halleri, and the elixir vitrioli Mynsichti), answer the same purpose better. Besides the vascular system the digestive system requires to be attended to, for there are frequent symptoms of gastric and hepatic derangement; in such cases we may ensure a recovery by the use of the Marienbad, Kissingen, and Ems waters, or by the exhibition of alkalies in combination with gum resins, and by enemata. A tonic dyspepsia is a very common complication, which requires to be combated by bitters, such as quassia, the menyanthes trifoliata, and ox gall. We have yet to mention an organic apparatus, which deserves our special attention in the treatment of hysteria, both on account of its important secretory functions, and because, from its large supply of sensory nerves, it bears a close relation to reflex action, we speak of the skin. Baths affect it in the most extensive manner, and a proper selection of the method, the temperature, and the remedial agents to be added to the water, cannot fail to aid the therapeutics of hysteria. Thus, in an erethitic state, the admirable baths of Schlangenbad, and baths of whey, are peculiarly appropriate; in a torpid condition sea-baths and cold affusion to the head and back should be perseveringly employed. The good effect of cold has been more especially recognised of late years, a fact to which we must not be blinded by numerous extravagances that have been committed by the hydropathic school. Inunctions and frictions exert a much less decided influence.

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[1] [See Editor's note [2], vol. I, p. 190.]—Ed.

[2] [Both these mineral waters are strongly impregnated with a suboxide of iron, and contain, in addition, salts of soda and potass, and other ingredients. Pyrmont, which lies in the principality of Waldeck, near Hanover, is considered the strongest chalybeate on the Continent.]—Ed.

Until very recently we possessed no sufficiently accurate knowledge of remedies capable of depressing reflex action, as contra-distinguished from others, *e. g.*, nux vomica, which possess the power of exalting it. Some experiments instituted upon animals induced Dr. Marshall Hall to assume this influence in hydrocyanic acid, and many physicians laud the effects of aqua laurocerasi in hysteria. Of late we have become acquainted with the influence of anæsthetics, sulphuric ether, and chloroform, in reducing and blunting reflex irritability; at all events we possess in these remedies very powerful palliative means for temporarily removing the pains and spasms of hysterical individuals.

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[1] [Prepared by boiling three pints of milk, with an ounce of the pulp of tamarinds, and straining; from one to two pints to be taken during the day. The composition of the Elixirs is given in vol. I, p. 89, *note*.]—Ed.

The third indication, that bearing upon the moral treatment, is of such importance, that without attending to it we shall fail in other attempts at cure. In order, however, to achieve our object, we must be careful to place ourselves in the proper relation to our patient. Those who abruptly tell an hysterical female that she must exert herself and not yield to her feelings, that her want of energy is the source of her complaint, and the cause of discomfort to her friends, is certain to lose her confidence, and justly so. For how is the patient to acquire the conviction that it is necessary for her to oppose her will to the reflex influence? The physician should show her the means of spontaneously exciting the motor nerves. It is said of Tronchin, the pupil of Boerhaave, who enjoyed the practice among the higher orders in Paris, that he was in the habit of ordering his hysterical lady patients to polish the floors of their own rooms, a practice which was followed with much success. We should scarcely succeed in obtaining obedience to such orders at present, but we possess other means of achieving the same object. Among these I lay great stress upon reading aloud. The ancients looked upon this as a part of their gymnastics, and appreciated its influence upon digestion. Thus, Celsus[1] says, in reference to the former point: "Commode vero exercent clara lectio, arma, pilæ, cursus, ambulatio," &c., and in reference to the latter: "Si quis vero stomacho laborat legere clare debet; si laxius intestinum dolere consuevit, quod colum nominant, indagandum est ut concoquat aliquis, ut lectione, aliisque generibus exerceatur. Prodest etiam adversus tardam concoctionem clare legere." Besides, it gives rise to a mental reaction; and it is very useful even as a palliative remedy, for I know no other which so rapidly dissipates the yawning and other respiratory spasms of hysterical subjects. Gymnastic exercises, the use of dumbbells, swimming, riding, ascending mountains, quick running to a definite distance, are of great use, and may even be employed on the approach of an attack. But we must not forget the maxim which applies particularly to hysterical females — that variety is pleasing. Change in the mode of life and even powerful emotions, are often very beneficial, both in their immediate and consecutive effects.

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[1] De Medicinâ, l. i, pp. 21 and 25, ed. Targa.

We must have recourse to palliative remedies for the purpose of diminishing the paroxysms and removing single unpleasant symptoms, nor should we ever overlook the accidental exciting causes. An emetic often proves more effectual than the most powerful antihysteric remedies. To the latter belong the antispasmodics that are distinguished by their unpleasant odour, assafœtida, castoreum, ambra, valerian, and some of the preparations of ammonia; the following formula may be recommended:

℞. Aq. Antihysteric. Prag.,[1]
Aq. Rutæ,
Syr. Croci, āā, ℥j.
M. S. cochleare majus pro dosi; vel pro enemate.

I have repeatedly derived, not only a palliative, but also a permanently beneficial result, in the neuralgic and convulsive affections of hysterical females, from the exhibition of arsenic, in doses of from three to four drops of Fowler's solution. There are other cases in which we cannot dispense with the use of opium and morphia.

The sensitive contact (sensible contact), abused by impostors and their victims under the name of animal magnetism, is not unfrequently useful, by diminishing reflex action. In violent convulsions, we may avail ourselves of the withdrawal of the stimulus of light by bandaging the eyes. A general rule to be observed, both in the radical and palliative treatment of hysteria, is, that we should avoid all debilitating influences, and especially the excitement of sudden discharges, because they increase the reflex action, and give rise to unpleasant phenomena. Whatever remedies are required for internal administration, should be prescribed in a pleasing form, and in small quantities. Dark mixtures of eight ounces, piled up pill boxes, which the hypochondriac delights in, alarm the hysterical patient, and create tedium.

The question whether the male sex is exposed to hysteria, is affirmed by some and denied by others; while there are others again who determine the point by ascribing to hypochondriasis in the male sex the same signification as to hysteria in the female. We have already adverted to this opinion, and have demonstrated that it is untenable.[1] If we define hysteria to be a reflex neurosis dependent upon sexual irritation, it may be assumed, *à priori,* that if a similar irritation occurs in the male sex, it will induce like phenomena; experience shows this to be the case. In the anæmic state occasionally accompanying the development of puberty in boys, which, like the chlorosis of girls, may be prolonged into manhood, symptoms of an hysterical character are rarely absent. This is yet more frequently the case in the irritation resulting from masturbation and other sexual excesses. We here find that on account of the loss of vital fluids, the irritable debility soon passes into a torpid state, and the powers residing in the spinal cord fail. The chief difference in the hysteria of the two sexes lies in this; in the male sex it is a transitory affection, which does not acquire so firm a hold as to establish the important psychical relation, independent of the other modifications induced by the uterine system. In the female sex, on the other hand, the source of the disease is permanent.

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[1] [The Aqua anti-hysterica Pragensis is a distilled water, prepared from assafœtida, valerian, galbanum, castoreum, and myrrh, and other aromatic vegetable substances.]—Ed.

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[1] See vol. I, p. 185.

CHAPTER XXIV.

SPASMS FROM INCREASED REFLEX EXCITABILITY.

TETANUS.

Next in order to the reflex neurosis originating in sexual irritation, that form comes under our consideration which depends either upon an injury or a morbid affection of peripheral nerves of sensation, or upon an irremediable affection of the spinal cord. We speak of the phenomena comprised under the term Tetanus.

The following are the general characters of the disease: Spasms in the muscles supplied by the cerebro-spinal nerves; permanent exaltation of the reflex function, in consequence of which every stimulus acquires an unlimited influence in exciting convulsions; enduring contraction of the muscles affected with spasm, whether one or more, a rapid course, and imminent danger.

Among the various forms of tetanic affection, none is so fully understood and described as

TRAUMATIC TETANUS.

An interval of varying length elapses between the period of injury and the outbreak of the disease; prodromi occur at this time, with which it is the more important to be acquainted, as they may be easily overlooked from their apparently trivial character. They are a return of pain and tenderness in the seat of injury, even after it has healed and cicatrised. Morgan,[1] one of the most faithful observers of tetanus, relates a case of injury of the hand, in which two months after the wound had entirely healed, and when neither the use of the limb nor external pressure caused pain, a neuralgic pain in the muscles of the thumb preceded the occurrence of tetanus. At the post-mortem examination, two splinters of wood were found in the abductor pollicis, pressing upon a branch of the radial nerve.

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[1] A Lecture on Tetanus; London, 1833, p. 7.

Horripilations, which are generally misinterpreted as febricitations, are frequent, and may amount to violent rigors, as occurred in one of my own patients. Pain in the neck, accompanied by slight dysphagia, is apt to confirm the assumption of a slight catarrh. The outbreak of the spasmodic attack may occur at the seat of injury, or at a distance from it. In the former case, the muscles of the wounded part contract rigidly, or twitch violently from time to time; this local spasm precedes the general convulsions, like an aura.[1] It is much more usual to find the cramp commencing in the muscles of mastication and deglutition, from whence it extends to the muscular layers of the back, the anterior surfaces of the trunk, and, less frequently, to the extremities; it gives rise to a difficulty or impossibility of swallowing, or of separating the jaws, and induces dyspnœa, retroversion of the head and trunk, and extension of the limbs. The reflex tension is extreme from the commencement; motor discharges into the muscles either occur spontaneously, and convulsive agitation of the trunk and respiratory spasms alternate with free intermissions, or they are excited by the slightest irritation, by pressure upon the wounded part, by touching the skin, by shaking the bed or floor, or by commotion of the surrounding air, by noise, by attempts at deglutition, and even by the effect of the imagination; the mere desire to drink, or to attempt any movement, causes the patient to shudder and start, which prevents him from carrying out his intention. Besides the alternation between contraction and relaxation, between spasmodic attacks and intervals of rest, we find that individual muscles continue in an excessive degree of motor tension, which may even induce a laceration of the muscular fibres. The features themselves denote a state of tension; the sharp outlines giving a peculiar tetanic expression, and causing the patient to look aged. The contraction is most persistent and strongest in the masseters, temporal, and in the cervical and abdominal muscles; agonising pain in the muscles, like that occurring in cramp of the calves, commonly accompanies the paroxysm; and the attempt at extending the contracted muscles, opening the mouth and moving the head. Many patients are heard to complain of intense pain extending from the pit of the stomach, under the ensiform cartilage, to the back, and preceding the spasms, especially of the abdominal and thoracic muscles. Anxiety and dyspnœa are frequent accompaniments. Consciousness and the special senses continue unimpaired; sleep is broken, sometimes it induces a remission of the muscular tension, which returns on waking up.[1] The voice is often altered, rough and weak. The action of the heart is generally accelerated; chiefly so during the paroxysms, during which the beats of the heart and pulse rise to 120—140. At the same time, we find the skin covered with copious perspiration, the temperature being generally reduced at the same time. The urine is scanty, of a pale colour, and clear, its discharge is often arrested. There is obstinate constipation, and defecation is occasionally impeded by spasm of the sphincter.

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[1] Consult—Dupuytren; Traité théorique et pratique des Blessures par Armes de Guerre, pp. 51—54; and Key, in Guy's Hosp. Reports, vol. i, p. 119.

With such symptoms as those just described, the disease runs its course more or less rapidly; its duration is commonly from two to four days, and it may only last a few hours; but we are not without instances of tetanus continuing for from two to four or even five weeks. Death ensues from strangulation, with violent convulsive throes, or, more rarely, in consequence of extreme exhaustion during the remission, after a deceptive appearance of rest and relaxation. In the majority of cases traumatic tetanus occurs during the first four days after injury; Dr. Friedrichs[2] found this to be the case in 83 out of 128 fatal cases. Recovery is effected slowly, generally between the second and fourth weeks, with a gradual remission of the tetanic spasms, in individual groups of muscles, and without marked crises.

After death the contraction of the muscles generally ceases, and the body remains flaccid for a few hours before the rigor mortis supervenes. On one occasion, however, Sommer[3] saw the tetanic spasm in the jaws, in which the rigor mortis also generally commences, directly pass into the latter. Rupture of the muscular fibres, with extravasation of blood, has been met with in several instances. Larrey[1] and Curling[2] saw it in the rectus abdominis; Dupuytren[3] in the cervical muscles; and Earle[4] in the psoas major and rectus. Other changes affecting the muscular tissue have already been spoken of at vol. I, p. 281. We may often discover alterations in the peripheral nerves, on close examination, and they are of great importance. Thus, foreign bodies have been found in the seat of injury; in a case recorded by Dupuytren,[5] it was the knot of a whipthong imbedded in the ulnar nerve; in another by Béclard,[6] the knot of a ligature was discovered in the sciatic nerve. The hand of a tetanic patient is preserved in the Anatomical Museum of Berlin, in the volar surface of which a fragment of the twig of a tree was discovered. The nerve has been found partially divided,[7] inflamed, indurated, and thickened[8] in the vicinity of the wound; and these effects have been met with, not only at the seat of injury, but even at a distance, in the course of the nerve to the spinal cord. Lepelletier,[9] in 1826, communicated several cases to the Acadamy at Paris, in which the inflammation was found to have extended along the neurilemma, from the point of injury to the meninges of the spinal cord. In a boy aged 15, three days after the amputation of his leg, the flap having healed, the stump became very sensitive, and twitchings of the muscles supervened; on the sixth day trismus and respiratory spasms showed themselves, and on the eighth death closed the scene. A small abscess was found to have formed in the stump, and there was inflammation in the adjacent parts. The sciatic nerve at this point was softened, of a purple colour, much injected with blood, and presented the same appearance eight or ten inches upwards towards the hip. The pia mater of the spinal cord itself was softened in the middle of the dorsal region. Curling[10] adduces two cases in which the inflammation caused small islets with intervening healthy tissue. Froriep[1] has recently published some admirable investigations, from which it appears that tetanus may be induced by a direct injury of the nerves, both by pressure applied indirectly through the surrounding soft parts, and directly upon the isolated nerve, as well as by puncture, laceration, and contusion; in all the cases, seven in number, the irritated nerves presented a similar peculiar inflammatory change, extending from the seat of injury to the spinal cord, and consisting in nodulated tumefaction and reddening of isolated points separated from one another by tracts of unaltered tissue, alterations which are not found in other cases, and especially where there is no tetanus. Aronssohn[2] first pointed out the occurrence of congestion and inflammation of the semilunar ganglia in traumatic tetanus; and Swan[3] has again directed attention to this subject. As to the post-mortem characters found in the brain and spinal cord, we can only say that they are very inconstant. We find congestion, inflammation, exudation, softening, induration. The limited experience of individual observers has often misled them to form hasty conclusions and misinterpretations. The same applies to the alterations in other organs, the lungs, or the intestinal canal, which depend either upon the fatal issue being caused by asphyxia, or upon complications, or the effect of the remedies employed.

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[1] Curling; A Treatise on Tetanus; London, 1836, p. 20.

[2] See the excellent Dissertation by this author—De Tetano traumatico; Be rol., 1837, p. 17.

[3] Müller's Elements of Physiol., transl. by Dr. Baly, vol. ii, p. 891.

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[1] Clinique Chirurg., vol. i, p. 122.

[2] Loc. cit., p. 75.

[3] Loc. cit., p. 55.

[4] Med.-Chir. Trans., vol. vi, p. 93.

[5] Loc. cit., p. 57.

[6] Descot; sur les Affections locales des Nerfs, p. 98.

[7] Swan; A Treatise on Diseases and Injuries of the Nerves, new edit., p. 343.

[8] Curling; loc. cit., p. 67.

[9] Revue Médicale, 1827, vol. iv, p. 183.

[10] Loc. cit., p. 73.

In reference to the *etiology* of the disease, we must first attend to the traumatic element. There is no kind of injury, however different in seat or character, which has not given rise to tetanus; but the most frequent causes of the affection are punctured and lacerated wounds, by splinters of wood, nails, &c. (of the 176 cases collected in the dissertation above quoted, 71 belonged to this class), contusions, fractures with comminution of the bone (61 cases), gunshot wounds (33 cases), amputation (11 cases), and, less frequently, other surgical operations, burns, &c. As the extremities are much more frequently exposed to lesions, and especially the hands and feet, it is not remarkable that tetanus most frequently follows injuries of these parts; that of

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[1] Ueber die Natur des Wundstarrkrampfs und die Behandlung desselben, in: Neue Notizen aus dem Gebiete der Natur und Heilkunde, 1837, vol. i, No. 1.

[2] Lobstein; De Nervi Sympathetici Humani Fabrica, Usu et Morbis, p. 152.

[3] Loc. cit., p. 333.

128 cases put together by Curling, 110 resulted from injuries to the extremities, and of these, 69 to the hands and feet. In most instances, especially in the case of punctured wounds, cicatrisation has already commenced, or has been effected, so that the patient often scarcely remembers the injury, if it was trifling, and a careful examination is necessary to discover it. In a case of tetanus which I examined in 1824, the patient, a labouring man, denied all knowledge of any injury, and it was not until the extremities had been washed that a lesion was discovered on the back of the right foot; it was a hard cicatrix of a puncture received ten days previously by a pitchfork falling upon the limb. Not unfrequently tetanus occurs during suppuration; and while the former runs its course Travers[1] states that the healing process may continue. The period at which the disease supervenes varies; it is the exception to find it occur during the first few hours or days after the receipt of the injury; generally it sets in in the course of fourteen, less frequently of twenty-one days, and still less after this period. The greatest number of attacks falls between the third and tenth days, at least in 112 out of 208.

We know too little as yet of the causes which favour the commencement of tetanus after an injury. We may meet with some differences as to age and sex; thus, 166 patients were from five to forty years of age, whilst there were only 32 in the ages of from the first to the fifth, and the fortieth to the seventieth years; of 252 patients, 210 were males, 42 females; the difference in the latter case is referable rather to the more or less frequent opportunity of injury, and this is also the case with reference to the different ranks and trades. The influence of certain atmospheric climates and psychical relations is more decided. All[2] surgeons, and especially those who have had extensive opportunities for observations on fields of battle and in military hospitals, agree that a sudden change from heat and drought to cold and moisture, is apt to promote the development of the disease.

The sudden impression of a cold current of air or a draught, may often be shown to act as an exciting cause.[1] Dupuytren observed, that tetanus was most apt to occur in hospitals that were badly ventilated, when cold draughts impinged upon the patients. The tropical climates favour tetanus, and the dark races, especially in a state of slavery, are more frequently exposed to it than Europeans. The effect of endemic influences may be gathered from the varying ratio in which the disease is met with in different countries. Thus, in Berlin, even in hospitals, tetanus is a most unfrequent occurrence. Mental emotions exert a considerable influence in producing it, and especially fright by a sudden noise, firing cannon, or alarm-bells at night, which Dupuytren[2] states to have been the cause of its outbreak in many of the sufferers brought to the Hôtel Dieu, during the revolution of July. A more important part in the production of the disease has been attributed, by some authors (Abernethy, Swan,) to gastric irritation, inflammation, abnormal secretions in the intestines, and helminthiasis, than we are warranted by established facts in admitting. The cause that has least frequently been observed to give rise to tetanus is difficult parturition. It is probable that, in an etiological respect, the diminution in the frequency of tetanus in modern times, may be attributed to the improved and more considerate treatment of the wounded. About the middle of the last century, Lind[3] stated, that after amputations, five out of six cases terminated fatally; while Sir Gilbert Blane, in his 'Diseases of Seamen,' (p. 3,) mentions that of 810 soldiers, wounded in April 1782, in the West Indies, 30 were attacked with tetanus, 17 of whom died. On the other hand, Dickson[4] proves the great diminution of its frequency in modern naval wars, by data contained in his own reports, and in those of others; he states that in 23 cases of amputation there was only one case of tetanus.

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[1] A further Inquiry concerning Constitutional Irritation, p. 301.

[2] Schmucker; Chirurgische Wahrnehmungen, vol. ii, Case VI.—Larrey; Clinique Chirurgicale, vol. i, p. 90.

Diagnosis and Nosology.—The extreme exaltation of reflex irritability is the criterion which distinguishes tetanus from other spasmodic affections that reside in the spinal cord.

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[1] Hennen; Principles of Military Surgery, 3d ed., vol. i, p. 224.

[2] Loc. cit., p. 51.

[3] An Essay on the most effectual Means of Preserving the Health of Seamen in the Royal Navy, 1757.

[4] On Tetanus, in Medico-Chirurg. Trans., 1816, vol. vii, p. 461.

Similar motor discharges, similar spasmodic contortions, occur in spinal meningitis, but the despotism, if I may be allowed the expression, of the reflex function is wanting, which places the muscular apparatus of a prize-fighter under the control of a trifling irritation of the cutaneous surface. This, too, constitutes its distinction from the spasms of individual groups of muscles, such as those of mastication, even when brought on by influences analogous to those by which the tetanic affection is excited, and to which I have already drawn attention in the description of facial spasms. In the divisions of tetanus hitherto made, this element has been overlooked; it follows that they were neither scientifically nor technically advantageous, and even added to the already existing confusion. A meaningless division has been made, according to the difference of the muscular layers attacked by spasm, into trismus, orthotonus, opisthotonus, emprosthotonus, and pleurosthotonus; the last two varieties are extremely rare; trismus may be altogether absent,[1] and in fact it is not the contraction, nor the posture it gives rise to, which characterises tetanus. The distinction as to time—acute and chronic tetanus—is as little tenable as the classification, according to the region affected; the same conditions are the causes of the disease, whether it runs its course in a certain number of hours or days; besides it would be difficult to justify the application of the term *chronic* to a cycle of a few weeks. The nosological distinction between symptomatic and idiopathic tetanus is not permissible, for the centripetal excitement, by traumatic irritation of the nerves, merely bears an etiological relation to the disease, by causing the reflex tension to be augmented. Lastly, we must term as perfectly erroneous the division into an inflammatory and spasmodic form, or, as Curling has proposed, into the acute, the acute inflammatory, and the chronic form. The present matter affords, in addition to innumerable other instances, a proof that pedantic classification cannot serve as a substitute for the absence of pathological truth.

The physiological investigation of the tetanic affection, though not completed, has proved more fruitful. We have already pointed out, that it is not necessary that a *conscious* sensation be excited in order to produce reflex actions; thus we frequently see the reflex irritation in tetanus rise to the highest pitch, without being accompanied by any serious sense of pain; the cases are not very unfrequent in which the patient has entirely forgotten the lesion. It is necessary that an interval should elapse between the period of injury and of the eruption of the disease, in order that the spinal cord be placed in that degree of reflex tension, which we are able at once to produce, in decapitated animals, by wounding the spinal cord, or in other cases, by poisoning. Instances are on record, in which the tetanus is said to have supervened at the moment of injury; but in these cases, mere reflex twitchings must have been confounded with a tetanic affection, or the latter was already making its approach; such was the case in the following observation, related by Swan.[1] Blizard performed the operation of popliteal aneurism upon a woman, according to the old method, by opening the sack, and applying a ligature above and below the tumour. Everything went on satisfactorily, until one day the attempt was made to change the position of the limb from the flexed to the extended position, when the patient uttered a terrific scream, soon after was attacked with tetanus, and died. At the cadaveric inspection, it appeared that the cutaneous nerve, which accompanies the lesser saphenous vein, had been divided in the operation, and that the upper end, which had become adherent to the surrounding parts, had been abruptly separated in the attempt at extension. The peripheral irritation, which extends to the spinal cord, and which is manifested in the insulated propagation of the inflammation of the neurilemma, continues, after the outbreak of the disease, in its definite relation to the central functions, a circumstance which is of consequence in regard to therapeutics. Travers[2] relates, that a man was attacked with violent tetanic spasms, after an amputation of the thigh. On examining the stump, the crural nerve was found included in a ligature, on the removal of which the spasm gradually ceased. The phenomena of exalted reflex irritability themselves, present peculiarities not merely in the motor but also in the sensory sphere. It results from the ingenious experiments instituted by Stannius,[1] that in the tetanus of frogs, produced by poisoning with strychnine, the centripetal nerves experience an extraordinary exaltation of their excitability, or are simultaneously irritated; and that being thus charged, they react upon the spinal cord, and through its agency give rise to the peculiar spasms. The exalted irritability of the centripetal nerves may be observed in every case of tetanus, even if the cerebral sensibility is at zero, as we sometimes see it in individuals of a bœotian stamp. The person who, during the most painful operation, or injury, remains unmoved, starts on being attacked by tetanus, and shudders convulsively the moment his skin is touched. The reflex impulse is not, however, communicated equally to all motor tracts; the cerebro-spinal are much more frequently and violently involved than the sympathetic; some even assume the former to be exclusively affected, but whether this is the case is not yet decided; for in order that we may form a correct judgment on the action of the heart in this disease, the pulse alone is not a sufficient criterium, but a careful auscultatory examination is also requisite. The mere increase of the frequency of the pulse during the convulsive paroxysm, cannot be taken as a proof of the spasmodic action of the heart, as all muscular contractions are known to exert a considerable influence upon the movements of the organ. The following observation, recorded by Howship, interesting as it may be, is as yet too isolated to establish a point in pathology; in a tetanic patient, who had complained of violent pains in the region of the heart, and who was examined eleven hours after death, while the body was still warm, the heart was found to be so much shortened, especially in its vertical diameter, that it only occupied the fourth part of the pericardial cavity. The resistance it presented to the touch, was that of an excessively dense or horny body. The auricles and ventricles were much contracted, the walls of the left ventricle were closely approximated to one another, so that on section the cavity was scarcely perceptible. There was about half an ounce of blood in the right ventricle, an ounce in the right auricle, and a much smaller quantity in the left. The heart was removed, and again examined a few hours later, when it was found completely relaxed, larger, and softer.[1] Nor are the sympathetic nerves the only ones that are exempt from the reflex impulse; there are certain sets among the cerebro-spinal nerves which are peculiarly liable to be affected; thus the masticatory and respiratory nerves are frequently affected, while the nerves of the extremities continue in the normal state. A few cases are even related in which the tetanic symptoms were limited to one side of the body, which was the same as that on which the lesion was situated.

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[1] Dupuytren; loc. cit., p. 54.

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[1] Loc. cit., p. 341.

[2] Loc. cit., p. 321.

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[1] Ueber die Einwirkung des Strychnins auf das Nervensystem, in Müller's Archiv, 1837, p. 231.

Prognosis and Treatment.—Although tetanus is reckoned among the most fatal diseases, it appears that hitherto the accompanying circumstances (climate, nursing, fatigue, emotions, &c.) have been regarded too little in forming the prognosis. We may satisfy ourselves of this fact by comparing the observations made by medical men in the tropics, and those of army surgeons, with the tables drawn up by Mr. Curling and Dr. Friedrich. In the latter, we see that nearly half the cases were saved, while in the former, as in the case of Macgrigor's[2] report of the Peninsular campaign, among several hundred instances of the disease, there were but very few recoveries. We possess no trustworthy prognostic indications for the individual cases as yet. The safest guide appears to be the course and duration of the intervals between the convulsive paroxysms. If they follow one another very rapidly, and if the reflex tension presents no interruption, when, in fact, the tetanus offers the character of a morbus acutissimus, we must resign all hopes. Whenever a cure has been obtained, the course of the disease was generally of an indolent character, extending over weeks, and the paroxysms being divided by long intervals. Parry[3] lays great stress upon the frequency of the pulse as an indication; he has asserted, that if in an adult the pulse does not present a frequency of 100 to 110 beats on the fourth or fifth day, a recovery may generally be anticipated; whereas the issue is almost certain to be fatal if the pulse mounts up to 120 or more on the first day. Other observers do not support this statement.[4] The state of the respiratory functions is of more consequence in reference to the prognosis; the early supervention and frequent recurrence of suffocative attacks imply great danger.

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[1] Curling; loc. cit., p. 11.

[2] Report on the Diseases of the Army, in Medico-Chirurg. Trans., vol. vi, p. 449.

[3] Cases of Tetanus and Rabies Contagiosa, 1814, p. 18.

[4] Curling; loc. cit., p. 15.

Observations are on record of spontaneous cures having occurred, even under very awkward circumstances. Macgrigor relates, that a soldier, after a trifling injury of one finger, was seized with violent tetanus during a march. His comrades did not like to leave him behind in a wretched Spanish mountain hamlet, and had him brought on after the regiment in a car drawn by oxen. From 6 o'clock in the morning till 10 o'clock at night he remained exposed to rain, snow, and an alternation of temperature from 52° to 30° F., he arrived at the night quarters half frozen to death, but free from tetanus. Morgan, Astley Cooper, and others, have also seen recovery ensue, in solitary cases, without any artificial assistance, but these were all of the more sluggish form of the disease. The results of treatment correspond with the remarks which have just been made; they amount to this, that whenever tetanus puts on the most acute form, no curative proceeding will avail, whilst in the milder and more tardy form, the most various remedies have been followed by a cure.

The main object of treatment undoubtedly is to remove the source of reflex irritation, and to lower the reflex irritability. Surgical interference is especially recommended in order to carry out the former indication, and in accordance with it nerves have been repeatedly excised or divided, or limbs amputated. The most eminent surgeons of modern times coincide as to the impropriety of performing amputation after tetanus has actually occurred, as the operation itself, as well as its consequences, inflammation and suppuration, will only increase the reflex irritability still more; Dupuytren[1] did not see a good result follow this method, even when the spasm proceeded from the injured part. The success which has followed the division of the irritated nerves, in some instances, is more encouraging; thus, Murray[2] met with a case in which a sailor boy, of 15 years of age, was attacked with tetanus, in consequence of his having run a rusty nail into the sole of his left foot; the accident occurred in the month of August, 1832, during a voyage to Madras, at 9 o'clock at night. He had to keep watch all night, the weather being cold and boisterous, and his foot giving him severe pain. On the following morning at 8 o'clock, he complained of stiffness in the muscles of the maxillæ and neck, which rapidly increased in intensity; his face expressed anxiety, his lips were swollen and livid. The maxillæ were so closely approximated to one another that it was with difficulty that a thin piece of wood could be inserted between them. Two hours later the spasm extended to the muscles of the back, the injured limb felt cold to the touch, and there was tenderness in the vicinity of the wound. The pulse made 120 beats, and the whole condition of the patient indicated extreme danger. As the remedies employed produced no effect, Dr. Murray resolved upon dividing the posterior tibial nerve. It was found swollen to double its size, and after being raised upon an aneurism needle, was rapidly divided; the pain was intense, but the patient instantly opened his mouth, and exclaimed, in great delight, that his leg had come to life again. Three days after the tetanic paroxysms had entirely disappeared, there was no impediment in walking, and the only trace of the injury remaining, was insensibility of the heel and little toe. We possess other records of cases, which, however, are less detailed, and leave it doubtful whether trismus was to be considered as a symbol of a tetanic affection; but whether or no, the division of the nerve by an experienced operator, combined with the employment of the local abstraction of blood, ought to be tried both at the commencement and in the further course of the disease, although it frequently has been ineffectual.

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[1] Loc. cit., p. 51.

[2] Grainger; Observations on the Structure and Functions of the Spinal Cord, p. 97.

The dietetic regimen must be contrived so as to diminish the excess of reflex irritability. The tetanic patient should be confined in a dark room, at a distance from all noise and disturbing visitors; every unnecessary movement or contact should be avoided, and especially all violent attempts at deglutition, which are almost unavoidably followed by convulsive paroxysms. Such advice as that of Larrey, to introduce a thin tube through the choanæ into the œsophagus, or to extract some of the teeth for the purpose of introducing the medicines, are objectionable. The temperature should be elevated; the atmosphere, as Dupuytren has proposed, be rendered moist and relaxing by the aid of steam. Ambroise Paré[1] cured a patient who was attacked with tetanus a fortnight after amputation of the forearm, by enveloping him in dung; he says in his quaint style: "Or je ne puis obmettre à raconter que quinze jours après survuint au pauure soldat un spasme, lequel j'avois prognostiqué, à cause du froid, et qu'il estoit mal couché en un grenier, là où non seulement auoit peu de couuerture, mais aussi estoit exposé à tous les vents, sans feu et autres choses nécessaires à la vie humaine; en le voyant en tel spasme et rétraction des membres, les dents serrées, les lèvres et toute la fasse tortue et retirée, comme s'il eust voulu rire du rire sardonic, qui sont signes manifestes de conuulsion, émeu de pitié, et desirant faire le deu de mon art, ne pouuant autre chose lui faire pour lors, le fis mettre en une étable en laquelle estait un grand nombre de bestail et grande quantité de fumier; puis trouuay moyen d'auoir du feu en deux réchauds près lesquels luy frottay la nucque, bras, et jambes, euitant les parties pectorales, avec liniments, ci-devant escrits pour les rétractions et spasmes. Après envelloppay le dit patient en un drap chaud, le situant au dit fumier, très bien couuert, où il demeura trois jours et trois nuits sans se lever dedans, lequel lui suruint un petit fluxe de ventre et une grosse sueur. Par ces moyens fut guéri du dit spasme."

On account of the extreme prostration of the nervous power, which accompanies tetanus from its commencement or supervenes during its course, an antiphlogistic, impoverishing diet is unsuitable; and recent experience, especially that of British medical men, coincides as to the propriety of the copious administration of wine, strong broths, &c., in order to counteract the collapse.

The observations hitherto made do not allow of definite indications being fixed for the employment of certain remedies; although some writers seek to establish them with more of pedantry than science. There is no disease in which we feel the absence of genuine therapeutic experience more than here. The imminent danger rarely allows the medical man to be satisfied with one remedy, and even therapeutic incompatibles are fearlessly given one after the other. Nevertheless the prevailing predilection in favour of opium continues, and we rarely miss it among the prescriptions for tetanic patients, so that we are sure also to find it mentioned in the successful cases. Our distrust is also awakened by the manner in which the doses are played with, the more so when we contrast the use of such enormous doses as 3¾ ounces in twenty-four hours, for eleven days successively, or of more than 4lbs. of the tincture, and 6 ounces 4¾ drachms of solid opium, in ten days, with the observation made by Abernethy,[1] who found 30 drachms of solid opium undissolved in the stomach of a person who had died of tetanus. The tolerance of the stomach appears to be generally diminished in regard to all medicinal impressions, and the power of absorption to be lessened. Travers[2] mentions the case of a patient whose pupils were much contracted, and were not dilated after the exhibition of one scruple of the extract of belladonna. It becomes the more necessary to introduce the remedy into the system by other channels; Dupuytren[3] recommended the employment of opium by enemata in tetanus; and endermic applications, as well as the attempts at transfusion made by Laurent and Percy,[4] are worthy of being repeated. The effect of tobacco appears to be more relied upon; it should be given in the form of an enema, with an infusion of from four to six ounces upon ℈j to ʒss of the leaf, to be repeated according to the strength of the patient, and the violence of the spasms. It is absolutely necessary to follow its use up with strong broth, wine, volatile stimulants, ammonia, alcohol, rum, &c., for the prostration caused by the remedy is extreme, and a momentary relaxation of the motor tension of the abdominal and masticatory muscles ensues.[5] The greater hopes were cherished from the therapeutic effects of etherisation upon tetanic subjects, as it abolishes reflex action in the normal condition, and because Pickfort's[6] experiments have shown that strychnine produces no tetanic attacks in etherised animals; the hopes that have been raised have only been realised in regard to the palliative effect of ether. Dr. Kniesling[1] has carefully observed a case of tetanus, in which chloroform produced the following effects: Unconsciousness and sleep ensued rapidly and at once, without previous excitement; the sopor was complete, the sleep peaceful, and the respiration equable and light. The waking up was sudden, without any transition, and the intellect of the patient was at once perfectly clear. The pulse invariably was retarded after the first few inhalations, without any previous acceleration; at the same time it became fuller and harder, and recovered its softness towards the end of the narcotised state. During etherisation the abdominal muscles were constantly relaxed, the muscles of mastication less tense, and complete lock-jaw did not supervene until death. Chloroform exerted no influence upon the muscular rigidity of the spinal column, and only in a few instances the movements of the trunk seemed again to be painful immediately on waking up. The pupils did not appear to be sensibly influenced. The reflex spasms were entirely arrested so long as the sopor and sleep continued. If the sopor was complete immediately after inhalation, loud noises and rough handling produced no effects; at a later period, a gentle step in the room sufficed to awaken the patient and re-excite the spasms. The efficacy of other remedies is too uncertain to demand a notice here. We cannot even say anything in favour of warm baths or cold affusion, as all handling of the patient promotes an outbreak of the spasms, and instances are on record of death having suddenly supervened in the cold bath. A more important indication consists in keeping the bowels open with enemata and drastic purges. The abstraction of blood, more particularly general and copious venæsection, are not advisable in tetanus, as it increases the exaltation of the reflex functions and accelerates the collapse. In the case of a successful issue, we must protect the patient for a length of time from cold or mental emotions. A patient, who was under the care of Mr. Aston Key[2] and had recovered, died suddenly from the shock of a powerful emotion.

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[1] Œuvres d'Ambroise Paré, lib. xii, c. 28.

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[1] Curling; loc. cit., p. 152.

[2] Loc. cit., p. 318.

[3] Mémoire sur la Fracture de l'Extrémité inférieure du Péroné, in Annuaire des Hôpitaux.

[4] Curling; p. 201.

[5] See a Treatise by De Ricci on the Treatment of Tetanus, in Dublin Quarterly Journal, August, 1850.

[6] Zeitschrift für rationelle Medicin, vi, 1.

In the treatment of hysteria we have dwelt upon the importance of directing our attention to the mind of the patient.

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[1] Deutsche Klinik, 1849, p. 74.

[2] Travers; loc. cit., p. 302.

It is a question whether we are also able to avail ourselves therapeutically of the opposition of the cerebral to the reflex impulse. The following case, reported by Cruveilhier,[1] an observer who is too conscientious that we could doubt the facts, would seem to favour the assumption that it is possible. A young, man, aged 20, in consequence of a contusion of the thumb, was attacked with tetanus, accompanied by spasmodic convulsions of the respiratory muscles, and especially of the diaphragm. All remedies failed, and on the tenth day the danger was imminent, when it struck Cruveilhier that he might oppose a voluntary to the involuntary contraction of the muscles. Assuming that the muscle could not obey two stimuli at the same time, and that the more powerful would obtain the mastery over the weaker, he advised the patient to make deep inhalations in rapid rhythmical order; and in order to facilitate these movements, he indicated the time by alternately elevating and lowering his arm. The result exceeded all expectation;[2] the convulsive jerks of the muscles of the trunk and the muscles of respiration, which previously had recurred every minute, did not return for half an hour, when the patient, entirely exhausted, had ceased from his rhythmical inhalations. The experiment was repeated with the same effect. At last the patient went to sleep and slept for two hours. On the following day the improvement was very marked; the convulsive movements only recurred at long intervals, and disappeared as soon as the patient had recourse to the rhythmical inhalations. This also occurred on the following days, and on the 26th the recovery was complete.

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[1] Observation sur le Traitement du Tétanus traumatique, in Révue Médic. Franç. et Etrang., 1834, vol. ii, p. 83.

[2] See vol. I, p. 365.

CHAPTER XXV.

SPASMS FROM INCREASED REFLEX EXCITABILITY.

TETANUS (TRISMUS) NEONATORUM.

The usual precursors of this affection are: screaming during sleep, starting, distortion of the mouth, tension and hardness of the abdomen, a leaden ashy ring encircling the lips,[1] a sharp, peculiar cry, during which the child throws its limbs about violently, bores backwards with its head, seizes the nipple violently, pushes it away as suddenly, and again screams.[2] The commencement of the disease is characterised by increased reflex excitability, by convulsive paroxysms, and a persistent tension of single groups of muscles. Among these, the muscles of mastication are first attacked; they maintain the lower jaw in an immovable position, separated from the upper jaw by an interval of a few lines, and slightly advanced. The histrionic muscles of the face are more frequently affected than they are in the tetanus of adults; the skin of the forehead forms single large transverse folds, which extend to the temples, the eyelids are closed spasmodically, the mouth points, and is surrounded by radiating folds.

The spasm also extends to the cervical and dorsal muscles, and the head is generally drawn backwards. The reflex tension is so great that every stimulus gives rise to twitchings. Hillary already pointed out that the spasms are suddenly induced at times, by merely feeling the pulse or touching the dress of the child. In a case recently brought under my notice, the most violent spasms were induced as soon as I touched the navel. A bright light, loud noise, attempts at deglutition after the milk has been introduced into the mouth by spoon, are followed by the same effects. But even independently of all external influences, convulsive agitation may ensue; suffocation threatens, the complexion becomes blue, and the extremities stiff. These attacks alternate with intervals of rest, during which the child is quiet, generally lying on one side, the face presenting a yellow tinge, the pulse becoming calmer, and beating 108 to 115 times in a minute. The evacuations and the urine are scanty, and at times entirely arrested. As the disease advances, the collapse is rendered more and more apparent, the face shrivels up, the entire body becomes rapidly emaciated, sudamina appear on the neck and chest, the temperature falls, the beats of the heart and pulse become irregular, the twitchings more frequent, and death ensues during a paroxysm, or during a state of extreme exhaustion, quietly, imperceptibly, even after the trismus has ceased.

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[1] J. P. Frank; Interpret. Clinic.: de Trismo infantum Tergesti Endemico, p. 372.

[2] Finckh; über den sporadischen Krampf der Neugeborenen, mit einer Vorrede von Elsässer; Stuttgart, 1835, p. 6.

The disease has an acute type; it generally lasts from two to four days, but its duration is at times limited to from eight to twenty-four hours, and occasionally, though rarely, it extends to five and nine days. A case of thirty-one days' duration, with a fatal issue, observed by Elsässer, in a boy of nine years old, must be looked upon as exceptional. When of very short duration, the spasm is often limited to the maxillary muscles, and does not extend further.

Complications with other diseases are rare; the statements formerly made with regard to the connection with icterus neonatorum were erroneous, and were owing to a misconception of the normal changes in the complexion of new-born infants. In twenty-five cases, Elsässer only twice saw trismus complicated with aphthæ, and twice with blepharophthalmia; the latter suddenly disappearing after the trismus showed itself. Dr. Schöller has several times found it complicated with icterus, with blepharophthalmia, and once with stomatitis exudativa.

Elsässer and Finckh have found that the rigidity of the features continues after death, that the muscles present a woody stiffness and a sharply-defined outline; the arms and feet being drawn up to the trunk, and the fingers and toes bent in an extreme degree. These authors were the first to examine the central nervous organs, the brain and spinal cord, in this disease. In sixteen out of twenty cases, an effusion of partly fluid and partly coagulated dark red blood was found in the cellular interspace between the ligamentous lining of the spinal canal and the dura mater; this was most marked on the posterior surface, although the subjects had been kept lying on their bellies. The meninges were normal, excepting some vascular congestion in some instances. The spinal cord itself was healthy, as far as could be determined by its colour, texture, and consistency. In the cranial cavity there was congestion of the membranes, sinuses, and cloroid plexuses; and in eight cases, extravasation of blood, both on the surface, and of the cerebrum and the cerebellum. Without expressing any doubt as to the correctness of these reports, it is necessary for the due appreciation of the facts, to remind the reader of the considerable amount of congestion existing during the first years of life, both in the osseous and membranous investments of the brain and spinal cord; this will necessarily be increased by convulsive, and more especially by suffocative attacks. A short time ago I found, in a child of six days, which had died of tetanus, such intense congestion, affecting more particularly the veins and sinuses, that a slight touch and the removal of the cranial bones sufficed to produce extravasations of the partly coagulated and partly fluid blood. Dr. Schöller has met with sanguineous extravasation in the spinal cord in only one case out of eighteen. More importance is to be attached to the post-mortem appearance to which Dr. Schöller[1] has very recently directed attention, viz., the inflammation of the umbilical arteries. I am enabled, by the kindness of this physician, to make the following extracts from an unpublished treatise on the subject; "Of 18 children who died of trismus and were examined after death, this inflammation was met with in 15. The umbilical arteries were found swollen at the point where they approach the urinary bladder. The tumour was the shape of an olive, and in one instance was half a line long and four lines thick; whereas, in the normal condition, the umbilical arteries are scarcely a line in diameter. The external surface of the arteries appeared injected and reddened. On opening them, undeniable pus was found within the vessel, to a greater or less extent. The lining membrane was eroded, or covered with an albuminous exudation. Both arteries were not always equally inflamed; in three cases, one only was affected. It was a source of considerable interest to me, to meet with this condition, which the observations of Dr. Levi,[1] of Copenhagen, have also confirmed, in the case which I have mentioned above. It occurred in a boy, born easily of a healthy mother, and affected twenty-nine hours after birth with blepharophthalmia. On the fourth day, the remainder of the umbilical cord was detached; towards evening, the child became restless, and ceased to take the breast; trismus made its appearance in the course of the night. On the fifth day, I found all the characteristic symptoms of the disease. The convulsive paroxysms followed each other rapidly during the ensuing evening and night, and the morning after the child died. Twenty-eight hours later, on the 27th of October, 1841, the cadaveric section was made, by the master hand of Professor Schlemm, in the presence of Dr. Schöller and several other physicians. The navel was uninjured. The umbilical arteries were reddened and swollen in the vicinity of the navel; the right contained more pus than the left; the lining membrane was covered with a reddish exudation. There was considerable sanguineous congestion in the brain and spinal cord. In all new-born infants who had died of other complaints, Dr. Schöller has failed to discover, by the most minute examination, any inflammation of the umbilical arteries; a few times, however, he met with a yellow serous exudation in the subperitoneal cellular tissue adjoining the vessels. Colles[2] had previously, in numerous post-mortems, met with inflammation of the peritoneum in the vicinity of the umbilical vein and artery; and also coagulable lymph within the arteries, and thickening of their coats; but it was afterwards disputed by Labatt[3] and Thomson,[4] that these appearances were characteristic of trismus neonatorum. In a few cases, inflammation of the umbilical and in the hepatic veins; in a few others, inflammation of the anterior surface of the peritoneum has been met with. Schneemann, in nineteen cases, found the liver of a dark black colour and hard; in eight, there were minute points of suppuration, twice abscesses, and once pus throughout the course of the umbilical vein.[1]

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[1] Neue Zeitschrift für Geburtskunde, herausgegeben von Busch, d'Outrepont, und Ritgen, vol. v, p. 377.

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[1] Zeitschrift für Geburtskunde, von Busch, &c., vol. vii.

[2] Dublin Hospital Reports, vol. i, p. 285.

[3] Edin. Med. and Surg. Journal, vol. xv, p. 216.

[4] Ibid., vol. xviii, p. 41.

Causes.—Dr. Schöller has found that boys are more frequently affected than girls; out of nineteen cases, fourteen occurred in boys, and four in girls. Other writers have not found the same difference to prevail. In most instances the health of the mother was satisfactory, and the delivery was easy. The infants are almost always mature and well formed children. Sometimes several children are attacked successively in the same family. The disease makes its appearance between the fifth and ninth days. In the 200 cases which came under the notice of Riecke, in Stuttgart, in the course of forty-two years, it has never been found to appear before the fifth, rarely after the ninth, and never after the eleventh day.[2] The period at which the remains of the umbilical cord come away is that at which trismus generally commences. According to Finckh's observation, the navel, in ten out of twenty-five cases, was found dry and cicatrised, in the remainder it was either wet or swollen, with a bluish-red, inflamed edge at the margin of the navel, the cuplike depression in the middle being covered with a dirty viscid pus. In all cases in which the navel was not completely healed, it assumed a peculiar discoloured appearance on the eruption or during the continuance of the disease. Colles also found that it was superficially ulcerated, and that a soft yellow substance was deposited in the middle of the umbilicus. But in reference to these points, we must be as careful how we draw conclusions as in reference to the congestion of the brain and spinal cord; as Billard[3] has shown that in more than one third of all new-born infants the cord is inflamed and suppurates before it falls off, whilst Dr. Schöller has found the navel itself uninjured in all his cases of trismus; and in one child, who had an umbilical ulcer of eight lines in diameter, neither trismus nor other convulsions occurred. Some authors[4] have attributed the greater frequency of trismus neonatorum in negro children, in the West Indies, to maltreatment of the umbilical cord, without taking the influence of climate into consideration. Other lesions that have been cited as the cause of trismus, are laceration of the frænum linguæ with the nails,[1] the circumcision of Jews' children,[2] piercing the ears for earrings; but the records offer no guarantee for truthfulness of observation; the circumstance that a masticatory spasm may occur in new-born infants, independently of a tetanic basis, must not be overlooked.

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[1] Holscher's Annalen, 1840, vol. v, p. 484.

[2] Finckh; loc. cit., p. 7.

[3] Traité des Maladies des Enfans nouveaunés, et à la Mamelle; Paris, 1828, p. 25.

[4] See Curling on Tetanus, p. 215.

The climate and endemic relations have been more accurately determined. Maxwell states that, in the West Indian Archipelago, one quarter of the new-born infants die of trismus; in the colonies Essequibo and Demerara, according to Hancock,[3] the mortality from the same cause amounts to one half. Nor are the ravages of the disease confined to the tropics, for it also rages in the arctic circles. According to Dr. Holland's report, almost all the children born in Heimaey, an island of volcanic origin, lying near the south coast of Iceland, die of trismus, so that the population requires to be recruited by immigration from Iceland.[4] It also appears to be endemic in St. Kilda, one of the western islands of Scotland; the same is asserted of Triest, Minorca, &c. The disease is more frequent in the south of Germany than in the north. Döpp states the disease to be so rare in Petersburg that he only meets with it 20 times in the 4500 foundlings that he sees annually. It is probable that, as among ourselves, many cases do not come to the cognisance of the medical man; but remain, in the lower orders at least, in the charge of the midwives. Atmospheric changes exercise a great influence in inducing trismus; a sudden draught of cold air appears to be particularly liable to have this effect. Heim[5] relates that a citizen of Berlin lost two children successively on the seventh day after birth by trismus. When the second child fell ill, Heim remarked that its cradle was exposed to a draught. On the third accouchement of the lady the position of the cradle was altered, and this child remained exempt from the disease. Bajon[6] has communicated a still more remarkable occurrence; at a hamlet in the island of Cayenne, surrounded by mountains and dense forests, trismus was at one time only known to attack about one in every twelve or fifteen children; after a great part of the forest had been cut down, so as to allow access to the cold sea winds, almost all the new-born infants fell victims to trismus. In catholic countries, where baptism is performed during the first days of life, it is not improbable that the occurrence of the disease is favoured by carrying the infants to distant churches, especially if the weather happen to be rough and unpleasant. Würtemberg[1] district surgeons report that trismus prevails most in those parishes which are much scattered, so that the children have to be carried, in hot weather or cold, a considerable distance to the parish church. Impure air in the bedroom, and especially in lying-in wards, may produce it. Clarke[2] reports that up to the year 1782, of 17,600 children born in the Dublin Lying-in Hospital, 2944 had died of trismus. After he had introduced a better system of ventilation, only 419 out of 8033 children succumbed to the disease. It is doubtful whether, as some assume, emotional affections of the nursing mother or wetnurse may favour the development of the disease. Werlhof[3] found that three children of a mother, who nursed them herself, were carried off by trismus on the ninth day; the fourth child was made over to a wetnurse for several weeks, then restored to the mother, and remained healthy.

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[1] P. Frank; loc. cit., p. 375.

[2] Ackermann; Abhandlung über die Kenntniss und Heilung des Trismus; Nürnberg, 1778, p. 64.

[3] Observations on Tetanus Infantum, in Edin. Med. and Surg. Jour., vol. xxv, p. 343.

[4] Travels in the island of Iceland, by Sir G. S. Mackenzie; Edinburgh, 1811.

[5] Vermischte Medicinische Schriften; Leipzig, 1836, p. 193.

[6] Abhandlung von den Krankheiten auf der Insel Cayenne; Stendal, 1781. Translated from the French.

If we again glance at the above-mentioned causes, we cannot refuse to look upon tetanus neonatorum as one of traumatic origin. With very few exceptions it occurred after the remains of the cord have come away; most frequently about the fifth or sixth day, about the time when, according to Billard's[4] investigations, another process, that of exfoliation of the epidermis, is at its height. These two circumstances, induce in every new-born infant, a predisposition to tetanus; the inflammation of the umbilical arteries, which has recently been discovered, and the irritation of the umbilical nerves which is thus set up, necessarily promote its outbreak.[1] It is probable that, in traumatic tetanus, all causes remain inoperative, until the inflammatory irritation is propagated up to the spinal cord; in the same way every predisposition may exist in the new-born infant without giving rise to trismus, until inflammation of the umbilical vessels is set up; this may account for the rarity of the disease in spite of the prevalence of the causes.

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[1] Curling; loc. cit., p. 212.

[2] Finckh; loc. cit., p. 29.

[3] Problema de tenellorum convulsione maxillæ inferioris, in Commerc., Noric. 1734, hebd. vi, p. 42.

[4] Loc. cit., p. 36

Trismus of new-born infants is the most absolutely fatal of all children's diseases. Cases in which a cure has been effected must be received with great suspicion, unless the diagnosis be verified by very accurate details. The safest proceeding consists in warding off the disease by attending to the proper treatment of the navel, and by avoiding injurious influences. Hancock remarks, that the West Indian midwives, to prevent the occurrence of trismus, compress the end of the umbilical cord for a couple of minutes between their fingers, and then apply a red hot iron or glowing ember to it. The same writer states, that he found repeated immersion of the newborn infant in cold water to produce a beneficial result. Future observations must determine whether the abstraction of blood in the vicinity of the umbilicus is able to prevent the occurrence of trismus, or whether it is of any service after it has become developed. Hitherto all remedies have failed after the disease is fairly established. The local abstraction of blood from the head appears, by the statistics of the Stuttgart lying-in charity, to have accelerated the progress of the disease, while musk very remarkably protracted its course to the seventh and even to the ninth day. Lukewarm baths for a time relieved the spasmodic attacks, and facilitated the deglutition of the mother's milk that was dropped into the mouth. Dr. Rieke[2] succeeded in saving a new-born child that was attacked by tetanus, by giving him every hour a drop of the tincture of opium. About half a drachm was thus given to the child; after which, a drop was given it two or three hours during one day, until all the symptoms had vanished. A similar case, with an equally successful result, from the external and internal administration of laudanum, has been communicated in the 'Edinburgh Medical and Surgical Journal' by Dr. Furlonge.[1]

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[1] A full exposition of this matter is given in: Die Controverse über die Nerven des Nabelstranges und seiner Gefässe einer sorgfältigen Prüfung unterworfen, von Schott; Frankfurt, 1836, p. 36, seqq.

[2] Finckh; loc. cit., p. 52.

Tetanic affections, produced by irritation of peripheral nerves passing through organs and cavities, have not hitherto been made a subject of careful investigation. Observers have chiefly directed their attention to the traumatic irritation of cutaneous nerves, without reflecting that every irritated sensory fibre is capable of increasing the reflex sensibility of the spinal cord by centripetal action. Curling[2] quotes from Ploucquet's 'Literatura Medica Digesta' a few cases, in one of which the origin of tetanus was attributed to an ossified point in the pleura irritating the splanchnic nerve; in the other, to the sharp angle of an ossified gland in the vicinity of the trachea, which was said to have exerted the same influence upon the vagus. The following observation, by Dr. Bright,[3] is more detailed. The patient was attacked by pain in the right thorax, and by rheumatic tumefaction of several joints, in consequence of exposure to cold. On the fifth day of her illness she sought for medical advice. In spite of repeated venesections, the pleuritic pain and the dyspnœa increased; the pulse was much accelerated and irregular, and towards evening dysphagia supervened. The patient had great difficulty in opening her mouth. Excepting a wound received six months previously above the left eyebrow, which was perfectly healed at the time she came under observation, there was no external injury to which the symptoms were referable. Deglutition could only be effected with extreme difficulty, and it induced convulsions. The action of the heart was very quick and spasmodic, but there was no friction or other morbid sound. The trismus increased during night, and on the following morning the teeth were firmly clenched. The patient was unable to swallow her saliva. The face was expressive of extreme anxiety, the cervical and dorsal muscles were attacked with spasm. Pleuritic effusion was discovered at the inferior portion of the left lung, by the existence of a friction sound. In the course of the day, universal convulsions occurred repeatedly, and twenty hours after the outbreak of the trismus, death ensued. P.M.—The lungs were found gorged with blood, but permeable, with the exception of a small portion of the right lung in the vicinity of the diaphragm, and a yet smaller portion of the lower lobe of the left lung. The lower half of the right pleura, where it is reflected from the ribs to the diaphragm, was intensely inflamed, and covered with a thin layer of fibrine. The inflammation was yet more marked where the right pleura adjoined the right side of the pericardium. The phrenic nerve took its course through this nidus of inflammation, and upon the diaphragm it was covered with fresh flakes of exudation. The left pleura was also inflamed, and an abscess was found at its lower portion, in the vicinity of the diaphragm. The cavities of the cranium and spinal cord were not examined. Allied to this fact are the observations noted by Swan,[1] of the congested and inflamed condition of the semilunar and thoracic ganglia in tetanic patients; similar observations have been made by Aronssohn, and in horses the same condition has been remarked by Dupuy.

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[1] 1830, p. 57.

[2] Loc. cit., p. 66.

[3] Cases of Spasmodic Disease accompanying Affections of the Pericardium, in Med.-Chir. Trans.; London, 1839, vol. xxii, p. 5.

Tetanus may also originate as a primary affection of the central spinal apparatus, without irritation of the peripheral tracts; this is termed the idiopathic form; it presents itself in two varieties, as the rheumatic and toxic.

1. *Rheumatic tetanus* occurs more frequently in the tropics than in our latitudes, and is more common among the dark than the white races; it is brought on by sudden changes of heat and cold, and especially from the heat of the day to the cold of night; it results less frequently from emotions. Its symptoms do not differ from those of traumatic tetanus, but Thomson[2] considers it to be less acute. The danger is equally great, the treatment generally avails nothing, though a few

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[1] A Treatise on Diseases and Injuries of the Nerves; London, 1834, p. 334, and seqq.

[2] Remarks on Tropical Diseases, in Edin. Med. and Surg. Journal, vol. xviii, p. 40.

cases are recorded of successful treatment with diaphoretics, camphor, ammonia, and vapour baths.[1] The disease has been repeatedly confounded with inflammatory states of the spinal cord, which accounts for the praise bestowed upon antiphlogistic treatment. The diagnostic criteria consist in symptoms of exalted reflex action; it is from the absence of the latter that I was induced to consider the following case as one of myelitis, notwithstanding the presence of several tetanic symptoms.

A healthy man, 66 years of age, was attacked in the night, from the 19th to 20th of April, 1827, by a painful tension of the lower jaw, and a difficulty of opening his mouth. This increased on the 20th; the belly became hard and tense; the cervical muscles were rendered rigid, and the patient lay immovably on his back. I was called in on the 21st. I found the masseter and temporal muscles tense and hard; the jaws compressed, but still capable of being slightly separated by a powerful effort of the will. The cervical muscles were rigidly contracted, and the head was slightly bent backwards; the patient was incapable of raising himself or turning round, and when an evolution was accomplished, with the assistance of those about him, he screamed for pain. The superior and inferior extremities were easily moveable in all directions, and their muscles, especially the gastrocnemii, were flabby, while the abdominal muscles felt like a board. The temperature was elevated; the pulse full, strong, and making 112 beats; breathing was impeded; the bowels constipated, and the urinary secretion normal. The most minute examination neither showed an injury, nor was there any positive proof of a catarrhal affection. A copious venæsection and calomel and opium, gr. jss every two hours, were ordered. Attempts at movement or deglutition did not induce convulsions, nor was there any other evidence of exalted reflex excitability. The dyspnœa increased; consciousness remained unimpaired, and on the 22d of the same month, death ensued. At midday, on the 23d, the thermometer being at 13° 3′ R. (62° F.) the cadaveric inspection was made. Very little fluid was found in the cranial cavities; there was more at the base of the brain, and this was of a reddish colour. The density of the medulla oblongata presented a marked contrast to the great softening of the cervical portion of the cord, which exuded from its membranes on slight pressure. The dorsal portion was firm; the lumbar portion, again, almost liquid.

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[1] See Dr. Henoch's Beiträge zur Pathologie des Tetanus Traumaticus, in—Caspar's Wochenschrift, &c., 1843, No. 50.

2. *Toxic Tetanus* is produced by poisoning with strychnine and brucine, which are contained in different plants in varying proportions; strychnine is chiefly found in the strychnos nux vomica, the strychnos sancti Ignatii (which contains the largest amount of strychnine), the strychnos colubrina, and the strychnos tieuté, in which it is associated with only a small quantity of brucine;[1] brucine is found in the spurious angustura bark.[2] Strychnine exerts its tetanic influence upon all classes of animals, and, acccording to a verbal communication from the celebrated Professor Ehrenberg, even infusoria are not exempt from its control; he states that infusory animalcules are peculiarly adapted for examination, when rigidly extended by contact with a watery solution of strychnine. In a physiological point of view, the recent experiments of Dr. Stilling are very interesting; they shew that when strychnine is applied directly to the spinal cord, the functions of this organ are so changed that the nerves derived from it induce tetanic movements in the corresponding muscles. Dr. Stilling[3] removed the entire viscera, heart, lungs, stomach and intestines, from a considerable number of frogs, after which operation the nervous system still continues to perform its functions for a short time, from half an hour to an hour; he then exposed the brain and spinal cord, by removing the arches of the vertebræ and the cranium, and applied to some part of the spinal cord a single drop of a solution of acetate of strychnine. About five minutes later all the frogs thus treated, without exception, were seized with tetanus, as violent and universal as it is ever seen in the sound animal. A slight touch of one hind toe reproduced an equally general attack of tetanus, and a renewal was also induced by touching a toe of the anterior extremity, exactly as in entire frogs that have been poisoned by strychnine. Strychnine applied to any point of the spinal cord, ope-

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[1] Pelletier and Caventou, in—Annales de Chimie et Physique, xxvi, p. 56.

[2] Christison, On Poisons; Edin., 1836, p. 806.

[3] Untersuchungen über die Functionen des Rückenmarks und der Nerven; Leipzig, 1842, p. 40.

rates upon the entire spinal cord and brain, provided these organs have preserved their connection with the part moistened with the poison. There can be no doubt that this is the result simply of imbibition. Even when small doses of strychnine are given therapeutically, we may observe an exaltation of the reflex function. Dr. Köhler[1] remarks, in his report on the Berlin Hospital la Charité for 1833, that some individuals who took strychnine became so sensitive to external impressions that even when merely touched with a finger they at once broke out into an uncontrollable laughter. When poisoning is induced by larger doses, it is followed, after an interval of from five, ten, thirty minutes, by paroxysms of tetanus in their most violent and rapid form. Professor Emmert,[2] who has deserved so well of physiological toxicology, reports a fatal case of tetanus brought on by the employment of a decoction of the spurious angustura bark. After taking the third tablespoonful the patient, a boy of five years, complained to his mother that his arm trembled, and asked her why he was obliged to shake so. The tremor soon passed into violent convulsions. When Dr. Emmert touched his arm, in order to feel his pulse, a sudden and violent tetanic spasm supervened; the eyelids opened wide; the eyes projected rigidly and immovably; the lower jaw was firmly compressed against the upper one; both lips separated from one another so that the front teeth were exposed; the different muscles of the face were tense; the extremities were violently extended and rigid, and the spinal column and the head were violently drawn back. The trunk, and especially its inferior portion, was from time to time agitated by violent twitchings, like electric shocks passed along the spinal column; the body was raised; the respiration intermitted; and lips and cheeks assumed a livid hue. After the paroxysm, which lasted about half a minute, the patient respired with great difficulty with distended nostrils, which diminished after a time, but was not entirely lost, as little as the bluish colour of the otherwise red portions of the face. He repeatedly and positively denied that he suffered any pain. Every attempt at drinking instantly induced the spasm. Thus the patient had suffered five attacks, partly without an exciting cause, partly owing to a noise, partly because some part of the body was touched; in the intervals he would therefore not allow anybody to touch him, and he implored anybody who happened to approach him, not to touch him. After a renewed attempt at drinking, the last violent paroxysm supervened, which lasted a minute; on its termination the body became relaxed and flabby, and only a few more weak respiratory convulsive movements occurred at long intervals. Life had fled sixty-five minutes after the commencement of the attack. Christison[1] has recorded similar cases of poisoning with strychnine. Stark[2] relates a case of poisoning by strychnia in a man, who, in addition to the most violent spontaneous spasms, every now and then suffered from opisthotonus and thoracic spasm; the gentlest touch of any part of the body, even through the clothes, as well as the slightest current of air, caused by opening the door, or by a person walking through the room, excited a spasmodic jerking agitation of the entire body, resembling the shock of a Leyden-flask.

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[1] Jahresbericht über das Charité Krankenhaus zu Berlin, vom Jahr 1833, in Rust's Magazin für die gesammte Heilkunde, vol. xxvi, p. 48.

[2] Ueber die giftige Wirkung der unächten Angustura, in Hufeland's Journal für Practische Heilkunde, vol. xli, p. 73.

Death ensues, as in traumatic tetanus, during a convulsive attack, from asphyxia, or from extreme prostration; according to Segalas, even the irritability of the heart is entirely exhausted, so that in animals no further contractions are produced by stimuli, and life cannot be supported by artificial respiration.[3] The more rapidly death supervenes the less marked are the post-mortem appearances. In Emmert's case, and in another reported by Ollier, nothing of any consequence was found. The stomach and intestines have been occasionally found inflamed. Orfila and Ollivier[4] once met with serous effusion on the surface of the cerebellum, and softening of the entire cortical substance of the brain, and especially of the cerebellum. We know but little of the treatment; if called in immediately after the accident, we may expect to derive some benefit from evacuating the stomach by means of an emetic or the stomach pump. Donné states that iodine, bromine, and chlorine, are sure antidotes to strychnia, but only if taken within ten minutes of the poisoning. A grain of strychnia proved innocuous to animals, if followed up by tincture of iodine; two grains and a half of the iodide of strychnine produced no injurious effect.[1] We should, at all events, try inhalations with chloroform. The experiments made by Morgan[2] on the antidotal power of the poisons with which the Americans tip their arrows, to the East Indian poison, are extremely ingenious; the former is the ticunas or woorara poison, which possesses the opposite property to that of strychnia, as it caused instant paralysis,[3] the latter is the Javanese chetik, or upas ticuté, which Pelletier and Caventou state to contain strychnine.[4] A fatal dose of the Javanese poison was given to dogs, and as soon as the first tetanic symptoms showed themselves, the woorara was inoculated with such success as to restore the animal completely; it was necessary to apply a ligature, from time to time, above the point at which the woorara had been introduced, as this, from being the more active poison, in several cases proved fatal within two minutes. The woorara showed an analogous effect in the experiments that were performed in the London Veterinary School upon horses attacked with idiopathic tetanus. One horse that was labouring under tetanus, and whose jaws were so firmly closed that neither food nor medicine could be introduced, was inoculated with the woorara on the point of a poisoned arrow in the fleshy part of its shoulder. Ten minutes after, it fell down apparently dead; artificial respiration was at once commenced, and continued for four hours. The animal arose, to all appearance perfectly restored, and devoured its food ravenously; unfortunately, too much was given it during the night; its stomach was overfilled and distended, and this caused its death on the following day, though without the slightest return of the tetanus. Morgan concludes with the following observation: "I have no desire whatever to inoculate tetanic individuals with ticunas, but it is not beyond the bounds of possibility that one or other of the constituents of this poison may eventually prove useful in the treatment of tetanus."

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[1] Loc. cit., p. 800.

[2] Allgemeine Pathologie oder Allgemeine Naturlehre der Krankheit, 2 Abth., p. 1216.

[3] Magendie; Journal de Physiol., vol. ii, p. 361.

[4] Archives Gén. de Méd., vol. viii, p. 18.

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[1] Christison; loc. cit., p. 804.

[2] A Lecture on Tetanus; London, 1833, p. 32.

[3] See Emmert's Treatise, Ueber das Amerikanische Pfeilgift, in Meckel's Deutsches Archiv für Physiol., vol. iv, p. 165.

[4] Annales de Chimie, &c., vol. xxvi, p. 44.

CHAPTER XXVI.

SPASMS FROM INCREASED REFLEX EXCITABILITY.

HYDROPHOBIA.

The tetanic affections we have hitherto considered have shown us the reflex functions of the spinal cord in an exalted state, and we know that similar phenomena are capable of being produced in decapitated animals; we now turn to the consideration of a morbid condition belonging to the same class, the symptoms of which refer mainly to the medulla oblongata, as they manifest themselves in the functions of respiration and deglutition. It is the disease known under the name of hydrophobia, a toxoneurosis occurring in man after the communication of the poison of rabies.

A painful sensation in the bitten wound, which has already cicatrised, precedes the outbreak of the disease; the sensation passing towards the spinal cord; there is rarely a feeling of numbness, and still less frequently reddening and swelling of the cicatrix. Horripilations, terror, ill temper, disturbed sleep, headache, and febricitations, present themselves as precursors. But even without these forerunners, the individual may, on attempting to drink, be seized with a peculiar difficulty of swallowing, which consists less in an incapability of swallowing, than in an impediment presented to this function, by a difficulty of breathing; the patients uniformly describe their sensation as one of strangulation and suffocation, when they swallow, accompanied by great anxiety, which is increased at every repetition of the experiment. Sobbing inspiration precede, the shoulders are elevated, and the epigastrium is tumid, as in an attack of asthma. From the commencement, there is an excess of reflex tension, and convulsive agitation results from the most trifling irritation. The most extreme sensibility is manifested to the most indispensable vital stimuli, air and water; and which henceforth seem only to exert a hostile influence. Not only a current of air, produced by fanning, raising the bed-clothes, opening a door or window, but slighter oscillations of the atmosphere, by movements of other persons or animals, imperceptible to the healthy individual, are capable of exciting respiratory spasms and universal convulsions. The respiratory movements themselves may be converted into sources of reflex irritation. Youatt[1] observes, that strong inspirations, without seeing or touching water, give rise to spasmodic attacks; and Bright[2] expressly states of one of his patients, that he carefully avoided taking a full inspiration. On the other hand, we find that the contact of the lips and the cavity of the mouth with a fluid, and especially with water, at once excites respiratory spasm and spasmodic dysphagia; accompanied by starting of the whole body, twitchings of the face, and of the arm and hand that conveys the vessel to the mouth; the movements of deglutition, like respiratory efforts, act as irritants, and attempts to swallow the saliva or solid substances produce the same effect. Water and air of a low temperature are still more liable to produce it. But even without any external irritation, attacks of anxiety and strangulation supervene from time to time. The reflex excitability of the entire surface is coincidently exalted, so that unexpected contact,—touching the thigh with the edge of the chamber utensil, the falling of a few drops of urine upon the limb, sprinkling the skin with a few drops of water,—cause a shudder and gasping for breath, such as we see in a person who for the first time jumps into a cold bath, or has a pail of water poured over him. The relation of the psychical functions of the patient to the state of the reflex action is characteristic. The impressions excited by the respiratory spasm accompanying the first failures in the attempts at deglutition, are so vivid, that in spite of the raging thirst, the patient will not repeat the attempt, or only does it with extreme repugnance; everything that awakens the remembrance, whether an object presented to the mind or to the senses, induces a spasm of the respiratory muscles, or the muscles of deglutition. This applies equally to the contact of a current of air. The hurry and excitement with which voluntary movements are executed is most peculiar. The muscles, as Parry[3] appropriately remarks, appear to anticipate the determination of making a movement. The sudden starting up, the rapid leap out of bed, the extreme haste in walking, the violent seizure of a vessel, the wild gesticulations, and the excessive jactitation, prove the truth of the observation. It is also undeniable that the mind is excited, and it manifests itself by the loud and violent manner in which the patient speaks. The patient is disturbed by a fear of approaching danger; sleep is totally absent, or, if it visits the sufferer, it is interrupted by frightful dreams or spasmodic movements, resembling attempts at drinking. Inexpressible anxiety is depicted in the eyes and face, as the internal unceasing restlessness is mirrored in the gesticulations and movements. The patient complains of a burning pain in the thorax and at the pit of the stomach; the frequency of the pulse and the respiratory movements are excessively augmented, while the temperature and turgor of the skin is diminished; the secretions of the kidneys and intestinal canal are scanty, while the salivary secretion is increased, causing an accumulation of thick, vivid, frothy saliva in the mouth, and at the angles of the lips, which the patient makes vehement efforts to spit out. Vomiting frequently supervenes; priapism and satyriasis also occur, but less frequently. The restlessness reaches the highest pitch; to the spasms of deglutition and respiration, trismus and opisthotonus may be superadded; the excitement increases to mania; delirious dreams picture to the sufferer dangers, against which he combats with all his might; yet his attention is easily arrested by questions directed to him by the bystanders; he is restored to himself, and shows his consciousness to be undisturbed. The force of the disease is augmented from hour to hour. Death ensues from apoplexy or asphyxia, during a violent paroxysm of convulsions, or it may be from extreme exhaustion, quietly, even under the false semblance of incipient recovery, after the capability to drink had returned.

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[1] On Canine Madness; London, 1830, p. 10.

[2] Reports of Medical Cases, vol. ii, p. 583.

[3] Cases of Tetanus and Rabies Contagiosa; London, 1814, p. 77.

These features of hydrophobia are subject to modifications by age, sex, idiosyncracy, and treatment. In childhood, the ignorance of the consequences of the injury and the danger to life, allows an *insouciance* which contrasts strongly with the despairing frame of mind of adults; while it leaves the morbid condition more uncontrolled. In these cases mania is rarely met with; in the female sex, the psychical reaction is manifested with less violence than in the male. There are instances on record of hydrophobic patients retaining their self-command to the last moment, being perfectly conscious of their condition, and cautioning their friends against themselves. The treatment exerts an undeniable influence. Forcible restraint excites the madness to the utmost, while on the other hand, the excessive abstraction of blood induces a rapid loss of strength, such as is foreign to the disease itself.

The *duration* of hydrophobia, after it has actually broken out, is brief; it varies from thirty-six to ninety-six hours, and rarely lasts five or six days; the average being three days.

After death rapid putrescence supervenes, which is particularly manifested by the development of gas in the blood and cellular tissue. Trolliet[1] found a considerable accumulation of gas in the thoracic aorta, in the right and left ventricle, and on puncturing these parts bubbles of air issued with the blood. Froriep[2] met with many and large air-bubbles in the blood of the cardiac cavities, the aorta, and the pulmonary vessels; Morgagni[3] had previously made a similar observation, and Parry[4] found the cellular tissue of a boy of five years, who was examined five hours after death, emphysematous to such an extent, that, on pressure being applied, the epidermis appeared to stand off two inches and more from the muscles. The blood is dark coloured and thin, and flows freely and copiously from the divided vessels; it is easily absorbed by the tissues, causing a dark-red discoloration of the muscular fibres and of the heart, even after much blood has been abstracted during life; this accounts for the dark red colour of the lining serous membrane of the heart, the valves, and the inner coat of the larger arteries, especially the aorta. The examinations of the nervous apparatuses have hitherto only yielded negative results; viz., the absence of any remarkable changes, or such as would be considered characteristic of hydrophobia. Inflammation of the superficial nerves lying under the bitten part has been occasionally observed,[5] but it has not been found to extend to the other portion of the nerve, and it remains doubtful whether it was not rather to be imputed to the scarification and other irritant treatment employed than to the bite. Traces of inflammation in the vagus and other nerves, to which Autenrieth was the first to direct attention, have not been met by other accurate observers; and Krukenberg,[1] in a well-written case, has shown that it was not neuritis but imbibition which was the cause of the red colour of the nerves, the vagus, phrenic, and sympathetic. Recently, however, Froriep[2] has described the vagus, glosso-pharyngeus, cervical nerves, and the two upper cervical ganglia of the sympathetic, as being perfectly sound, while the third cervical ganglion, on each side of the neck, was dark red, of increased firmness, and presenting great vascular development. On division, these ganglia showed an increased amount of blood, and a granular appearance of the cut surfaces. They were much enlarged, being equal to the kernel of a plum, and much larger than the superior ganglion. This was all that was found morbid in the sympathetic, for the superior thoracic ganglion, as well as its inferior portion, was normal. Trolliet[3] mentions that the choroid plexus of the fourth ventricle, and its prolongation in the vicinity of the point of insertion of the vagi, are found much gorged. The majority of observers agree in testifying to the following changes in the respiratory organs: congestion, partial and general reddening of the mucous membranes, extending from the glottis to the finest bronchi, accumulation of frothy mucous fluid, engorgement of the lungs, with dark fluid blood containing many air bubbles, and lobular emphysema. Beyond the imbibition above spoken of, affecting the lining membrane and the muscular tissue, nothing of moment is found in the heart and large vessels. The cavity of the mouth is generally found to contain much viscid, whitish-yellow mucus. The papillæ of the tongue and the mucous glands of the mouth and pharynx are often much developed and prominent. Some patches of reddening and congestion of the vessels is visible at the pharynx and intestine, and especially in the stomach, the mucous membrane at these points being tumefied.

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[1] Nouveau Traité de la Rage; Lyon, 1820, p. 121.

[2] Medicin-Zeitung des Vereins für Heilkunde, 1836, p. 236.

[3] De Sedibus et Causis Morborum, epist. viii, art. 23, 27.

[4] Loc. cit., p. 65.

[5] See a Case, by Rosenthal, in Horn's Archiv für Med.-Erfahrungen, 1815, p. 539.

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[1] Horn's Archiv, 1817, p. 365.

[2] See his post-mortem Account appended to an admirable history of a Case by Wolff, in Med. Zeitung, &c., 1836, p. 236.

[3] Loc. cit., p. 135.

Although our repertory of hydrophobic cases is not scanty, we possess but few critical observations of the disease. The most distinguished are those of Parry, in the work already spoken of, Marcel,[1] Marshal,[2] Bright,[3] Clarus,[4] and some recorded by Horn[5] with those already quoted. In my own practice, only one case has occurred, which I observed with Professor Horn, in 1820.

Friedrich L—, æt. 6, of healthy conformation, was attacked, in the month of June, 1820, with a nervous fever, which lasted seven weeks. On his first walk, while visiting a relative, he was bitten by a dog. The child was sitting quietly on a chair, playing with pens, and on attempting to pick one up that had fallen to the ground, the dog of the gardener jumped at him, and bit the nail of the second finger of the left hand; the dog held on for some seconds, and only relaxed his grip on his master coming up.

The dog having already bitten several other children, was driven away; his master took off the collar on which the proprietor's name and address were engraved, opened the garden gate, and allowed him to escape; nothing more was heard of him. A few of the dog's hairs had first been cut off, to place upon the wound, which in eight days was completely healed. The boy in the interval remained perfectly healthy, except that a pustule showed itself on the tip of his nose, which persisted for a few days, and then dried up. His good spirits and animation were not in the least disturbed; and it was not till the 30th of August, twenty-eight days after the injury, that he complained of pain in the bitten finger, which the day after also involved the hand. The father at the same time observed, that even when the boy entered the room quietly, his breathing was laboured. He passed a restless night from the 31st August to the 1st of September; tossing about continually, so that it was necessary to make up another bed for the brother who generally slept in the same bed with him. He then slept till 6 o'clock.

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[1] Medico-Chirurg. Trans., vol. i, p. 132.

[2] Untersuchung des Gehirns im Wahnsinn, &c. übersetzt und von Anmerkungen begleitet von Romberg; Berlin, 1820, p. 19.

[3] Loc. cit., pp. 582—604.

[4] Der Krampf in Pathologischer und Therapeutischer Hinsicht systematisch erläutert, pp. 303—325.

[5] Archiv für Medic. Erfahrung, 1814, p. 461, 1815, p. 529.

Instead of the coffee which he usually had for breakfast, he asked his mother for water; but on seeing it he was said to have shuddered, and to have pushed it away forcibly. He was unable to swallow any other fluid or solid food; the mere sight of which was repulsive to him, for which reason he begged his parents and brothers and sisters not to dine in the same room. An emetic, which was prescribed and swallowed with considerable difficulty, only produced a slight effect. During the following night he manifested great restlessness, and constantly complained of violent thirst, and the impossibility of swallowing the beverage. On the 2d of September, pains in the entire left arm and ear supervened; a current of air produced by the mere elevation of the bed-clothes, sprinkling a few drops of urine on the skin, excited the same paroxysms as the attempts at drinking. Consciousness was unimpaired; he gave sensible answers to the questions addressed to him, and often expressed that he would willingly die if he could but first drink his fill. I saw the boy at five o'clock in the afternoon; he was lying on his back; his eyes were brilliant and rolled about, his face red, and his features expressed distressing anxiety. His tongue had a white coating; the skin was dry; the back and the extremities cool; the chest was the warmest part; the pulse full, very quick, as much as 160 beats in the minute; the impulse of the heart strong; the respiration accelerated in proportion to the pulse; the urine of a pale yellow colour; the movements were performed with energy and haste. I offered him a saucer full of beer, and challenged him to drink; the mere aspect of the saucer startled the boy, and as soon as I approached the cup to his lips, sobbing respiration, and a convulsive movement of the entire body ensued; he turned his head in the opposite direction, and rolled his eyes about wildly. The experiment was repeated three times, and each time the same phenomena recurred. When he caught sight of a glass of water, the restlessness was greater, and the shudder more violent. I now put the cup into the boy's hand and urged him to drink, telling him that he must die if he did not obey. He seized the cup with a trembling hand, and carried it to his mouth; he shuddered, and wanted to return the cup to me; but on my ordering him with a threatening voice to drink, he took courage, and in spite of the hiccup which supervened, swallowed about half a teaspoonful hastily, but with extreme difficulty. I then dipped the handle of a teaspoon into water, and for several minutes dropped the water off it upon his tongue. This trifling quantity he swallowed without much trouble or shuddering. I had a basin of water put by the bedside, and ordered the patient to wash his hands. He remained quiet on seeing this water, and washed his hands without exhibiting any change in his features or in his demeanour. The same was the case when a bright object was held before him, such as a mirror, or the polished surface of a watch; the last he evidently regarded with pleasure. On the other hand, he was very sensitive to the contact of cool air, especially if the current was strong; thus the quick airing of the bed-clothes produced effects similar to those brought on by attempts at drinking. The sound of the rain, while the window was open, produced no impression, but he showed great anxiety as soon as flies settled upon his face or hands, or upon the bed, he then called out to his father in great distress of mind to drive the flies away. The activity of the senses and his intellectual powers were unimpaired. He repeatedly denied that he suffered pain, nor did he exhibit the least sensation when pressure was applied to the thorax or the abdomen.

The features of the disease, as just now sketched, continued exactly the same during the hour and a half that I spent at the bedside of the child. The treatment consisted in taking twelve ounces of blood from the arm, scarifying and applying cantharides ointment to the cicatrix, rubbing in a scruple of mercurial ointment into the inner surface of the left arm, and giving two grains of calomel hourly. Greater calmness supervened after the venesection, during which the boy had sat on his father's lap; the movements became less hasty; he shuddered less when a glass of water was held up to him; but it was only upon the most urgent solicitation on the part of the parents, as well as of myself, that he could be induced to swallow the calomel powder. Dr. Horn visited the boy at 7 o'clock in the evening, and described his condition in the following terms: his features expressed extreme anxiety, his eyes told a tale of immeasurable misery, he tossed about constantly in bed, and could in no way obtain rest; his eyes rolled about, and in all his movements there was a certain expression of violence and force. He complained of nothing, but he started when anybody approached him, suddenly went up to him, or offered him something to drink. He objected much to taking medicine, or to the inunctions; he implored that he might not be touched nor be bled again; he desired nothing more than to be allowed perfect rest. The temperature of his skin was somewhat reduced, especially about the head, the hands, and the legs. The examination, and in fact every contact and approach, appeared to excite in him unpleasant emotions. There was not any frequent spitting. The pulse was hard, quick, and extremely frequent. It was repeatedly and accurately examined by a second hand, and found to amount to 180—190, and even 200 beats in the minute, the number of inspirations being at the same time from 45—50. He still continued able to look at and touch polished objects, such as a watch or a looking-glass, without experiencing any unpleasant sensations. He was utterly unable to drink water, tea, or beer. When the drinking vessel was brought near, he quickly averted his face, and pushed it aside with his hand. He attempted to convey a piece of soft plum tart to his mouth, but he spat it out almost before he had commenced sucking it. He put other delicacies that were offered him aside, saying that he would keep them for the morrow. The boy still exhibited strength enough in his movements, his posture, and his speech; the venesection was therefore repeated, and the dose of calomel repeated; scarcely two cupfuls of blood had been obtained, when the face and hands became markedly cooler, the pulse smaller, the voice weaker; but the expression was still brisk, the eye was bright and moveable, and the syncope that I expected did not supervene; still the changes mentioned induced me to arrest the flow of blood. The hydrophobic symptoms continued unabated, while the pulse, though much weaker, exhibited the same remarkable frequency as before. After having watched the unfortunate child for nearly an hour, I took my departure. Half an hour later death came to his relief.

The post-mortem examination was made on the4th September, five and twenty hours after death, in the presence of the late Dr. Heim, and several medical men, by the then officer of health of Berlin, Dr. Mertzdorf.

The corpse presented a saturated yellow tinge, intermingled in the cheeks with a livid red; the upper and lower extremities were flexible and flabby; the eyes were not so faded and dull as usual; in spite of the low temperature of the atmosphere, the smell of putrefaction was already developed. The muscles presented a dark red appearance; the lungs were strongly charged with blood. The larynx, the trachea, and œsophagus presented nothing abnormal, the tissues of these parts were pale. On the other hand, the redness of the heart was remarkable, the arteries and veins on its surface looking as if they had been injected. The mitral and aortic valves presented a scarlet hue, which remained unaltered even when repeatedly sponged. The trabeculæ carneæ were darker than usual, the internal surface of the aorta was of a bright red hue as far as the arch. The blood contained in the vessels was dark and fluid. The inner surface of the stomach was as pale as that of the œsophagus. No morbid change was found in any other abdominal organ. At the urgent request of the parents the head was not examined.

Etiology.—The exciting *cause* of the disease just described is the poison of rabies, which is generated in the dog and various animals of the canine species, such as the wolf, the fox, and the jackal, and may be communicated by them to other animals, such as cats, ruminantia, horses, pigs, and also to man; the communication may be made directly or by the intervention of another animal previously infected by a dog. Whether birds or amphibious animals are capable of taking the poison is unknown. The poison itself is of a fixed and not a volatile character, and capable of being propagated so long as the corpse has not become perfectly rigid; whereas it is never communicated by cutaneous or pulmonary exhalation through the intervention of the atmosphere. The ordinary vehicle is the saliva or mucus from the mouth of rabid dogs; but Hertwig[1] has shown, in his excellent contributions to knowledge of the canine madness, that unmixed saliva, taken from the salivary duct, portions of the salivary glands laid upon a wounded surface, and, lastly, the blood itself, venous and arterial, are capable of communicating the infection. An abrasion of the skin is necessary for the development of the poisonous effects. Both the cutis and the mucous membrane must be deprived of their

[1] In the Supplementary Number to Hufeland's Journal, 1828.

epithelial layer, whether the communication be made by mere contact (slaverving over excoriations) or by inoculation (bites). The effect produced by the poison depends upon the receptivity of the organism. Generally speaking the susceptibility for this poison is not very great, but it appears to be greater in dogs than in man or other animals. According to Hertwig's experiments, the proportion is somewhat above 23 per cent., hydrophobia appeared in 14 out of 59 dogs that had been inoculated. In some the contagion was effected after the first inoculation, others passed through two, three, and four inoculations, and then became infected; another resisted all inoculations that were made for three years, amounting to nine; while seven other dogs that, at different times, were inoculated with him, suffered from hydrophobia. Youatt states the proportion of poisonings after bites to be larger; he considers that two out of every three dogs who are bitten, are attacked by the disease. In horses it occurs with tolerable frequency, least frequently in sheep and in cattle. The susceptibility also appears to be slight in man: John Hunter[1] met with an instance in which 21 individuals were bitten by a mad dog; they took no precautions, yet only one was seized with hydrophobia. Vaughan and others communicate similar facts.[2] In other cases we meet with different results; thus, Trolliet gives the history of 23 persons who were bitten by a rabid wolf, 13 of whom were attacked with hydrophobia. In order to explain this difference, an importance has been attached to favorable circumstances, which is not justified by the rules of strict criticism. Thus, the bite of a mad wolf is said to be more surely poisonous than that of a dog.[3] Some writers have asserted that when hydrophobia is transferred from dogs to man, horses, or ruminants, it ceases to be communicable; they quote the experiments of Dupuy,[4] who invariably failed to inoculate oxen or sheep from animals of the same species, whereas these animals were at once seized if they were inoculated with the slaver of a mad dog.[5] This is met by a fact stated by Youatt, who saw a groom attacked with hydrophobia, in consequence of having caused an abrasion of his hand within the mouth of a mad horse, which he was physicking; we may also add that Magendie and Breschet communicated hydrophobia from a man to a dog. On the 19th July, 1813, they inoculated two dogs with the saliva of a man labouring under hydrophobia. One became mad on the 27th of July, and bit two other dogs, one of whom was attacked on the 20th August with hydrophobia.[1] This alone suffices to prove what Hertwig's experiments have yet more thoroughly demonstrated, that it is erroneous to assert that the poison loses its power by communication to a second and third subject. Some protection is afforded by the part being covered with hair, wool, or thick clothing, by which means the poison is intercepted; hence the greater danger arising from wounds of the face or hands.

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[1] Parry; loc. cit., p. 84.

[2] Andry; Recherches sur la Rage, p. 189.

[3] Trolliet; loc. cit., p. 170.

[4] See the article 'Rage,' in Dictionn. des Sciences Médic., vol. xlvii, p. 46.

[5] Loc. cit., p. 22.

An interval intervenes between the introduction of the poison and the appearance of the disease; an analysis of sixty authentic observations has shown, that the shortest period is 15 days, the longest from 7 to 9 months, and that the average period is from 4 to 7 weeks. The same infection presents differences, which are independent of age or sex, or the locality of the injury. Thus we find that in the 13 patients described by Trolliet, who had been bitten in one day by a mad wolfbitch, the hydrophobia made its appearance—

In six between the 15th and 30th day.
four „ 30th „ 40th „
two „ 40th „ 53d „
And in one, 3 months and 18 days after the bite.

Hertwig has found that in dogs the outbreak of the disease occurs within 50 days, whether the poisoning is effected by a bite or by inoculation.

All that we know of the interval, or as it has been termed, the period of infection, is what relates to its duration; the statements that have been made respecting phenomena, said to prove the occurrence of infection, are entirely untrustworthy and false. It has been asserted, that the bitten part assumes a peculiar appearance, that a tumefaction occurs around the bite, that vesicles and pustules are formed in the immediate vicinity of, and also at a distance from the wound,[1] under the tongue in the ducts of the submaxillary glands, between the third and ninth days after the injury; these so called hydrophobia vesicles have turned out to be a hoax practised by a peasant of the Ukraine. There is, however, a negative symptom, which, if confirmed by future observers, may be deserving of attention; it is the absence of an inflammatory swelling of neighbouring lymphatic glands and vessels occurring after the lesion, or after inoculation in animals.

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[1] Trolliet; loc. cit., p. 172.

It appears that accidental circumstances favour the development of the disease, after the poison has been received into the economy; bodily exertion, mental emotions, and especially fear, and external injuries, may act in this way, as we see in those cases in which the hydrophobia makes its appearance after the lapse of a longer interval than usual. In one of the patients, whose history is recorded by Trolliet, three months and a half had passed since the bite; he had been leading a very quiet life up to that time, but being seduced into the commission of excesses, he was returning from a fair one day, when he met a dog who suddenly attacked his horse; all the details of his own former accident recurred to his mind, a few days after the hydrophobia made its appearance, and carried him off on the third day. Lenhossek quotes two instances from older writers, (which, however, do not offer the guarantee of accurate and detailed delineation,) in which the hydrophobia was excited respectively six and nine months after the bite had been inflicted; in one owing to a kick, in the other, to a block of wood thrown at the cicatrix of the bite. Youatt observes, that also in animals the slumbering germ may be brought to life by excitement. The disease does not make its appearance in pregnant bitches until two or three days after they have littered; it is common to find it occurring while dogs are in heat.

Comparative pathology.—Our diagnosis of hydrophobia is confirmed by ascertaining the existence of rabies in the animal which has inflicted the injury. The present is the proper place to introduce these diagnostic experiences, although a separate chapter at the end of the work will be devoted to the consideration of the results afforded by comparative pathology, which are peculiarly important in relation to nervous diseases. So many errors had crept in, even into the nosology of canine rabies, and had been maintained by tradition, that great thanks are due to the distinguished veterinary surgeons by whose efforts the fallacies have been exposed. With us Germans, Hertwig, among the English, Meynell and Youatt, deserve especial mention, as observers who have shown the marked difference in the phenomena of the disease, as it affects the human or canine species. In the latter, Hertwig states the precursory symptoms to be either entirely absent, or not to be characterised by any peculiarity; Youatt has observed that the animal is in the constant habit of licking and scratching the wounded and cicatrised part, and that it will continue doing so with extreme violence, until the parts are perfectly lacerated. When hydrophobia has made its actual appearance, it assumes, according to Hertwig, either the form of wild or of still rabies. The former is marked by psychical excitement, the tendency to bite and to run, while depression and paralytic debility, especially of the lower jaw, obtain in the latter. The pathognomonic symptoms are particularly dwelt upon. 1. A peculiar alteration of the voice, and in the bark. The voice is rough, hoarse, and anxious. The bark does not consist of a rapid succession of separate sounds, but the first sound always passes into a short howl; so that the whole is neither a regular bark nor a howl, but something between the two; while uttering it the animal generally raises its head. Some are constantly emitting these sounds, without any cause, and for several days continuously, while others only do so rarely, and upon a given cause. 2. Youatt states, that respiration is always much affected; breathing is much impeded, and inspiration is accompanied by a rattle. 3. Psychical disturbances are manifested by change of behaviour and habits; and vary according to the race, the temperament, and the mode of living of the dog. Generally speaking, we find an internal anxiety manifested by restless running about, constant sidling over to the door, change of place, escaping from the house and wandering about in the streets, or in the fields; it shows itself in a tendency to bite and fly at other animals; in wild, savage dogs, this amounts to a mania for killing and destroying, which they exhibit towards living animals, and especially cats, as also to inanimate objects. When they bite other dogs, they generally select the mouth, or the genitals. (Hertwig.) Youatt has observed, that the dog shows signs of being delirious and seeing phantasms. The animal stares at a spot on the wall, suddenly darts at it, closes his eyes and drops his head; he will then look round him wildly, and pursue the trace of some object hovering before his mental vision; he is easily frightened, still his consciousness is not destroyed, for he hears the voice of his master, and even obeys his command. 4. Loss of appetite for solid, consistent articles of diet, with a strong inclination for heterogeneous objects, such as wood, straw, leather, wool, fragments of glass, and their own excrements. 5. Changes of appearance, reddening of the conjunctiva, with photophobia; in many a trifling degree of strabismus (Youatt), a rough, ragged coat, and rapid emaciation. 6. Discharge of saliva about the second day of the disease, lasting only ten or twelve hours, and followed by insatiable thirst. (Youatt.) Hertwig states, that the mouth only fills with saliva and mucus, when the pharynx is inflamed. 7. In the further course of the disease, a paralytic affection of the maxillary muscles and of the hind legs supervenes. 8. A negative, but no less important symptom, is the absence of fear of water or hydrophobia; rabid dogs are at all times able to see and to drink either water or other liquids; some only lick the water, but are unable to swallow it on account of the tumid state of the tongue, the pharynx, and the œsophagus. The disease invariably ends fatally, within from four to eight days; there is generally a gradual increase of exhaustion, occasionally death is sudden from apoplexy. At the post-mortem, the blood is found dark and tarry; the pharynx, and especially the tonsils, are swollen and inflamed; the epiglottis is found congested, and the posterior surface of the larynx is inflamed. (Youatt.) The mucous membrane of the stomach is most frequently found inflamed, and the stomach contains a variety of undigested substances, such as straw, hairs, horse-dung, earth, &c., a circumstance not observed in any other disease of the dog. The inflammation not unfrequently extends to the duodenum and jejunum. The brain and spinal cord are found gorged with blood, but they as little as the peripheral nerves, present any serious lesion. (Hertwig.) Youatt (p. 6,) states, that the medulla oblongata, and especially the olivary bodies, are intensely congested.

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[1] See V. Lenhossek: die Wuthkrankheit nach bisherigen Beobachtungen und Erfahrungen, pathologisch und therapeutisch dargestellt; Pesth, 1837, p. 280.

The reader is recommended to compare the symptoms of rabies when communicated to other animals, in the writings of Youatt (p. 7), and Lenhossek (pp. 113—124).

Diagnosis and Nosology.—The diagnostic advantages of a physiological interpretation of disease are rendered very apparent in examining the subject of rabies; the main feature in hydrophobia, as it affects man, is the excess of reflex tension in the common origin of the nerves of respiration and deglutition; it is manifested by increased excitability in relation to stimuli indispensable to life, as air and water, and by corresponding motor discharges by the nerves of deglutition and inspiration. This constitutes the difference between the fear of water, which is met with as a symptom of other diseases, and arising either from mere disgust or from erroneous impressions, or from spasm of the glottis and pharynx. Patients of this description are able to take a mouthful of water without manifesting any reflex excitement; nothing but deglutition is impeded, so that they are pacified as soon as they have spat out the fluid. It is scarcely necessary to advert to the different behaviour of the hydrophobic subject, in whom the mere sprinkling of the lips or a current of air excites the convulsive shudder and the peculiar respiratory spasm, for which reason it is useless to bandage the eyes in order to withdraw the water from the sight of the patient. The diagnosis becomes more difficult in those cases in which, after a bite of a dog, or of some other animal, in consequence of a cerebral affection, (generally acute hypochondriasis, less frequently meningitis,) hydrophobic symptoms manifest themselves. The points by which we are enabled to arrive at a correct conclusion, are the rapid occurrence of the phenomena after the injury, the absence of increased reflex action, the beneficial effect of mental soothing in hypochondriasis, the character of the delirium in phrenitis, the maniacal behaviour of the patient, and the tendency to bite and to destroy, which does not exist in genuine hydrophobia. We must not overlook the difference between the hydrophobic paroxysms in rabies, and the fear of water which accompanies other diseases. The former return spontaneously even without seeing water, and without any attempt to drink, in the waking or dosing state, and the obstacle is rather a respiratory than a pharyngeal spasm.

As I do not affect the popular maxim—ignotum per ignotius exponere, I shall take care not to draw analogies with other contagious diseases, in order to determine the pathogeny of rabies. We shall not fill out the chasms in our knowledge of the modus operandi of the hydrophobic poison by mere guessing; the only way to determine the questions at issue is to repeat experiments upon inoculated animals; we must seek to obtain evidence as to the effect of applying ligatures, or cupping-glasses, or excising the inoculated part at different periods, in arresting the introduction of the poison into the system; such experiments upon the non-conduction of the poison should be made on a large scale, in order to arrive at positive conclusions. The nosological relation of the disease has been variously regarded. Some have treated it as allied to insanity, others to convulsions; or again, on account of its traumatic origin, it has been classed with traumatic tetanus. This is manifestly erroneous, as the disease may result from the mere licking of chapped hands or excoriated lips by a mad dog, without any further local injury. On the other hand, the excess of reflex action places the disease in the category of tetanic affections, among which its exact place is defined by the symptoms, which plainly point to an affection of the medulla oblongata; this at once establishes the distinction between hydrophobia and other spasmodic convulsions.

The point just alluded to is also important in reference to prognosis; when rabies has become developed, we know of no remedy that will prevent the fatal issue. The cases that are recorded of a contrary result are untrustworthy, as they do not bear the test of strict criticism. During the period of incubation we may form a more favorable prognosis, but we must not overlook the fact of the absence of all susceptibility for the contagion that exists in a number of cases.

When science affords no sure footing, superstition is sure to flourish; the therapeutic literature of hydrophobia is replete with evidence to this effect. There are only two consolatory points to which the experiments at present conduct us; they are, 1, the certainty of general prophylactic measures; and 2, the possibility of prophylactic measures in the case of the individual. The former may be effected by government, by prohibiting unnecessary dogs; or, if this be too difficult to achieve, by limiting their number by a special tax, such as has been imposed in Berlin with the most beneficial results. Rabid dogs are now rarely met with, and it is only now and then that a hydrophobic subject is brought to the general hospital from one of the surrounding villages. But the attention of the government should not be confined to dogs; it should also be directed to the surveillance of cats, and the extermination of wolves.

The prophylactic treatment of the individual is effected after the injury has taken place, and has for its object the removal of the contagion which has been admitted into the wound. The safest proceeding consists in excising the bitten part, so as to include a portion of the healthy tissue, immediately after the lesion has occurred, though in a large number of wounds, especially when situated in the vicinity of vital organs, it is not feasible. Ligatures and the application of cupping-glasses may be employed, but they have been too little used to deserve any reliance. Almost all voices are agreed as to the necessity of destroying the seat of the poison. The actual cautery would answer this purpose most effectually were there any security of the entire surface of the wound being exposed to its action. It has therefore been proposed to combine excision with cauterisation. The celebrated London veterinary surgeon, Mr. Youatt, gives the preference to the nitrate of silver over all other cauterising agents; he protected himself by its application on four occasions when he was bitten by mad dogs, and has used it in more than 400 individuals who were bitten by dogs undoubtedly rabid with such satisfactory results that of all these only one was affected with hydrophobia. Rust[1] urgently advocated the use of a solution of caustic potash applied to the wound after excision, of the strength of half a drachm to twelve ounces of distilled water. The majority of authors are in favour of maintaining copious suppuration beyond the usual period of incubation. The sooner after the injury it is possible to take these precautions, the greater will be their protective power; but they should not be neglected even if a considerable time has elapsed without anything being done.

Some medical men, not satisfied with the adoption of more local prevention, have recommended a general preventive treatment. We here lose all indications, and the doubts necessarily suggest themselves whether the topical or the other remedies deserve the credit of preventing hydrophobia; this remark applies, for instance, to the method pursued by Dr. Wendt[1] in the Breslau Hospital. He kept up suppuration by filling the wound with powdered cantharides, and, at the same time, established copious salivation by the exhibition of calomel, and inunctions with mercurial ointment. We possess no antilyssic remedy which has been proved to be effectual, and neither cantharides, belladonna, nor meloe majalis, have answered the expectations raised concerning them.

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[1] Theoretischpraktisches Handbuch der Chirurgie, vol. ix, p. 286.

We cannot dispense with mental prophylactic treatment; everything that soothes and diverts the patients should be encouraged, and everything avoided which tends to recall the remembrance of the occurrence.

When the hydrophobia has made its appearance nothing remains for us to do, but conscientiously to fulfil all the duties commanded by philanthropy; we must entirely eschew all bodily restraint and severity, as the unfortunate individual suffers sufficiently from the conviction of the fatal nature of his disease; all manipulation tending to excite the exalted reflex irritability should be avoided, and this applies more particularly to the repetition of the attempts at drinking, in which the patient is allowed to see the fluid, and to feel it with his lips; the object may be better gained by dropping water upon the tongue, or allowing the patient to suck it through a tube, as in a case of Dr. Bright's, where a tobacco-pipe was employed. To the last moment we should offer the patient cheering consolation, and avoid mentioning the name of the disease.

We are constrained to confess that the therapeutic measures hitherto adopted have only proved "meditationes mortis." A few reports that have been sent over to us from the East Indies, seemed strongly in favour of copious venesection, and excited some hopes that a remedy had been discovered; but Parry[2] has already shown, that these cases bear criticism so little, that we are scarcely justified in adopting them as precedents. No successful case that deserves our confidence has as yet been placed on record. The same applies to opium, the dose of which has been carried to as extravagant a height as in tetanus, for Babington has given a patient as much as 180 grains of opium in eleven hours, without producing a narcotic or any other effect; cantharides, belladonna, mercury, cold affusion, and immersion into cold water, are equally useless. Youatt[1] relates an experiment of inoculating a rabid dog with the ticuna poison, which was followed by a subsidence of the excitement and great calm, but did not prevent the fatal issue. The inhalation of chloroform offers us a sure means of promoting the euthanasia of those unfortunate individuals.

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[1] Darstellung einer zweckmässigen und durch die Erfahrung erprobten Methode zur Verhütung der Wasserscheu; Breslau, 1824.

[2] Loc. cit., p. 94.

Authors have also assumed the existence of hydrophobia originally developed in man, (hydrophobia idiopathica spontanea, as opposed to hydrophobia communicata vel symptomatica;) but, although the analogy with tetanus would favour the presumption, the facts bearing upon the point are so rare and so unsatisfactory, that we can only look upon them as exceptions; we can scarcely help suspecting that, in these cases, the poison was communicated, but that no actual lesion having occurred, the patient had no data by which to recollect the occurrence.

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[1] Loc. cit., p. 51.

CHAPTER XXVII.

SPASMS FROM EXCITEMENT OF THE BRAIN.

Modern experimental physiology has done more towards elucidating the motor apparatus of the brain, as well as the sensory, than the older school. Recent inquirers have not only succeeded in determining the regions of the brain, which, when injured in the living animal, give rise to movements, but they have also demonstrated the existence of two forms of spasmodic movements, twitchings and vertigo.

The experiments of Flourens have shown, that twitchings only result from irritation of the medulla oblongata, or the corpora quadrigemina; they are never produced by irritation of the hemispheres of the cerebrum or cerebellum. Irritation of the medulla oblongata induces convulsions on the same side of the body, that of the corpora quadrigemina causes it on the opposite side. Eduard Weber[1] found that movements were only produced by stimulating the corpora quadrigemina, and that they did not occur in the shape of a permanent clonic spasm, as we see in direct irritation of the spinal cord, but presented a constant change; the movements at one time having the character of a concerted arrangement, at another the appearance of irregular clonic spasms.

The most ancient surgical observations mention convulsions as the concomitants of cerebral injuries; and from Hippocrates downwards, most medical men have admitted the correctness of the dictum, that convulsions occur on the injured side and paralysis on the opposite side; this statement has been impugned by Morgagni,[2] who argued that the observers had failed to examine both hemispheres with proper care; and by Flourens, who explained the phenomena by referring them to the combination of the injuries of the cerebrum and cerebellum, with those of the medulla oblongata and the corpora quadrigemina, which had been overlooked previously.

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[1] Ueber Muskelbewegung, loc. cit., p. 16.

[2] De Sedibus et Causis Morborum, epist. li, art. 46, 47, 48, and Epist. Anat. xiii, art. 14, 17, 18.

The morbid conditions of the brain most commonly accompanied by spasms, whether clonic or tonic, semilateral or bilateral (the former more frequently), are meningitis, morbid growths, hypertrophy, and, though less often, inflammation and softening of the cerebral tissue. The nerves of the eyes and the face are generally involved, and the convulsions prevail in the upper extremities. The relation these convulsions bear to paralysis, is a characteristic feature; they generally precede the occurrence of the latter, rarely following it, but frequently coexisting with it in the other half of the body. Cerebral twitchings are distinguished from those dependent upon peripheral or spinal lesions, by the law of crucial action. Apparent exceptions arise from a misinterpretation of changes met with at the base of the brain, which affect the motor nerves passing off at these points to their peripheral distribution, and give rise to convulsions of the corresponding side, as in the muscular range of the facial, the oculomotor, and other nerves.

It will be necessary to institute further researches into the contradictions prevailing between the facts presented to us by pathology and the results of direct experiment. It may suffice at present to quote a single undoubted case of unilateral twitchings from irritation of certain parts of the cerebrum and cerebellum, which is given by Andral.[1] It occurred in a young woman, aged 27, who was attacked by frontal headache and vertigo after being exposed to intense fatigue. A fortnight later violent twitchings of the left arm supervened, which returned in paroxysms, and lasted about twenty minutes. During the intervals, the motility of the limb was undisturbed. Soon after the left, and immediately after this the right, side of the face was attacked, and participated in the convulsions. Twenty-four hours later, consciousness still remaining unimpaired, the twitchings became more frequent, and attacked one or both sides, the upper extremities with greater force than the lower. They ceased on the supervention of sopor. The mouth became filled with bloody froth, and death ensued from asphyxia. The anterior lobe of the right hemisphere of the cerebrum, two inches below the convolutions, and near the Sylvian fissure, presented a considerable softening of the white substance of a dark red colour, and above a cubic inch in extent. The circumference was marked by considerable congestion. There was so much congestion at the corresponding part of the left hemisphere, that it looked like an ecchymosis; the consistency of the tissue was, however, unchanged.

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[1] Clinique Médicale, vol. v, p. 427. — See also Abercrombie; Pathological and Practical Researches on Diseases of the Brain, 3d ed., p. 73, &c.

If the anterior lobes of the cerebrum be ever so much irritated in the living animal, convulsions never result. The fact must be explained in the same way as the pains caused by inflammation and disorganisation in the cerebral tissue, though insensible to wounds or injuries.[1] The orgasm of the brain, from the organ being enclosed in unyielding osseous parietes, favours the propagation of a stimulus from the most remote points to the corpora quadrigemina and the medulla oblongata. This is the reason why convulsions commonly accompany hypertrophy of the brain,[2] and why the arrest of the purulent discharge, from penetrating wounds of the skull, often induces twitchings on the opposite side.[3] Abercrombie mentions the case of a child of eight months, whose fontanelle was considerably swollen, owing to exudation within the cranial cavity, and which was seized with convulsions whenever the tumour was pressed.

The twitchings of the muscles themselves, which accompany cerebral disease, in no way differ from the twitchings accompanying affections of the peripheral nerves and the spinal cord. It is very different with regard to the spasms which are produced in the living animal by experiments upon certain portions of the brain, and occur in man and animals as a result of morbid conditions.

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[1] See vol. I, p. 170.

[2] Andral; loc. cit., p. 599.

[3] Lallemand; Recherches Anatomiques et Pathologiques sur l'encéphale et ses dépendances, vol. ii, p. 122.

CHAPTER XXVIII.

SPASMS FROM EXCITEMENT OF THE BRAIN.

STATIC SPASMS, VERTIGINOUS MOVEMENTS.

Motus Vertiginosi.

One form of these movements may be correctly designated as—static spasms, or vertigo.

Experiments.—Older authors, Zinn, Saucerotte, Méhée de la Touche, (for whose views we refer to Gama, 'Traité des Plaies de Tète,' p. 15,) and Arnemann, incidentally speak of rotatory movements occurring in animals after cerebral injuries; but their physiological importance was first duly estimated by that philosopher, whose glance has diffused light wherever it penetrated, Alexander von Humboldt; he says, in his 'Versuche über die Gereizte Muskel und Nervenfaser,'[1] "This revolving of decapitated animals, whose spinal cord continues intact, is one of the most wonderful vital phenomena which have been elucidated by Mr. Arnemann's frightful experiments. I have observed that those frogs particularly continued to hop about in a narrow circle, to whose trunk a small portion of the medulla oblongata, which is very long and flattened in these animals, remained attached. It appeared as if the direction of the gyrations to the right or the left was determined by the residuary portion being larger on the right or the left side. If this was entirely removed, the rotatory movement ceased, but was capable of being re-excited by chemical stimuli, applied to the axillary or sympathetic nerve of the right or left side. It follows that the rotation always indicated a disturbance in the equilibrium in the medullary nerve tissue. In more modern times, the experiments of Magendie and Flourens have afforded important results, which have been confirmed by Krauss and Hertwig, as to the seat and modifications of these phenomena; it is sufficient for our purpose to adduce the following:

"1. Removal of both corpora striata induces an irresistible tendency to advance; the animal shoots straight forwards like an arrow. Removing one corpus striatum only, produces no such effect.[1] 2. Transverse sections of the pons varolii induces a tendency to fall forwards, (Krauss and Hertwig.) 3. Slicing the cerebellum, whether horizontally or vertically, causes the animal to walk backwards, (Krauss, Hertwig, and Magendie.) 4. Section of the corpora quadrigemina of one side, of one pedunculus cerebelli ad pontem, and of one side of the pons Varolii, excites rotatory movements and gyrations of the animal towards the injured side, the eyeballs being altered in their position and distorted; the bulb corresponding to the side of the lesion is turned downwards and forwards, the other upwards and backwards, (Flourens, Magendie.) 5. Division of the corresponding part on the opposite side restores the balance. (Magendie, Hertwig.)"

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[1] Berlin, 1797, vol. ii, p. 352.

Vertiginous movements were first brought to the notice of the pathologist, by veterinary surgeons directing attention to the rotatory disease of sheep; this is caused by the cœnurus cerebralis,[2] and the variations that occur in the movements are attributed to the different site of the parasite.[3] In the majority of cases, in which the acephalocyst is found within one of the cerebral hemispheres, it has appeared to me, from repeated observations made on the estate of a friend, that the movements are not gyrations, but rather inclinations of the semiparalysed and hemiplegic animals to the healthy side, such as we see in animals in whom one cerebral hemisphere has been removed; Kuers however states, that as the disease advances, the body revolves in smaller and smaller circles, and at last turns on the same spot, so that the feet become entangled in the straw. The cases are rarer in which the animal falls forwards, or in which, from the parasite residing in the vicinity of the cerebellum, or the medulla oblongata, there are vertiginous movements, while the head and neck are bent backwards.

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[1] Magendie; Leçons sur les Fonctions et les Maladies du Système Nerveux, vol. i, pp. 198, 248, and 280.

[2] Rudolphi; Entozoorum sive Vermium Intestinalium Historia Naturalis, vol. ii, pp. 243—246.

[3] Hertwig; art. Drehkrankheit, in—Encyclopedisches Wörterbuch der Medicin. Wissenschaften; Berlin, 1833, vol. ix, p. 458; and—Kuers, die drei wichtigsten Iugendkrankheiten der Schafe, die Träberkrankheit, Drehkrankheit und Lämmer-Lähmeng; Berlin, 1840, p. 61.

In man, static spasms rarely occur by themselves; they are generally associated with other cerebral affections; this is the reason why they did not attract any attention, until their bearings were elucidated by experimental physiology. The movements, which present an interesting parallel to vertiginous sensations (see vol. I, p. 93,) are forward or backward to the right or the left; the disturbance of the balance of forces which exists in health, is induced either by the weakness, or inactivity of the antagonising force, or by irritation and spasmodic impulse. We shall quote a few instances from our own experience, and from the records of other observers.

Vertiginous movements, with an impulse in the direction of the axis of the body.

1. *Forwards.*—Professor B., aged 71, had, during the last few years, frequently complained of headache, slight vertigo, and tinnitus aurium. One evening, in the middle of February, 1836, he was attacked in the street with such violent vertigo, that he fell down and remained insensible for some minutes; it was only by the assistance of a passer-by, that he was able to get up and slowly to crawl home. Immediately after, his speech was found to be impaired, and his memory for certain words and names had disappeared. In the beginning of March, he became a patient of Dr. Friedheim, to whom I am indebted for the present communication. The attacks of vertigo had recurred frequently, and were especially liable to supervene when he was out walking. A marked weakness of the lower extremities had also manifested itself, so that the patient was unable to raise his feet from the ground, but could only push them forwards. His features were remarkably relaxed, and corresponded in this respect to the intellectual dulness of the individual, which displayed itself in a marked manner in conversation. Derivatives, vegetable diet, and the use of the water of the Kreuzbrunnen, at Marienbad, during the month of June, exercised a most beneficial influence upon the vertigo, and upon the motility and strength of the feet. In July, however, a fresh apoplectic attack ensued, with paralysis of the left half of the face, and slight paralysis of the left leg, followed soon after by a remarkable tendency of the body to

fall forwards. In order to observe the occurrence more carefully, Dr. Friedheim often accompanied the gentleman in his walks; they would continue for five or even ten minutes to walk quietly side by side, when the patient suddenly began to walk quicker, and at last shot forward with a sudden impulse, the body bending forwards more and more, so that it was necessary quickly to lay hold of and sustain him. During the last months of his life, this occurrence was repeated much more frequently; he was even attacked while walking up and down in his room, and he stated—a fact that was confirmed by those about him—that if at the moment when he lost his balance he wanted to seize hold of an object, such as a tree or a chair, he often turned round it two or three times before he attained his object. His moral energy became more and more reduced, and his speech remained heavy and inarticulate. Towards the evening of the 15th of March he was seized with the third apoplectic attack, the right arm and leg becoming paralysed, the breathing stertorous, the pulse slow, the pupils enlarged, and the motions and urine passing off involuntarily. A brief amelioration followed the employment of the suitable remedies on the fourth day. The patient exhibited more consciousness, protruded his tongue, attempted to answer, tried to move the right arm; but, on the following day, the symptoms returned with renewed violence, and death ensued on the 24th of March, 1837. The post-mortem examination of the brain was made by Dr. Henle, in the presence of Dr. Barez, Dr. Friedheim, and myself; the cerebral tissue was found firm and tough, filled with blood, and presenting in the left lateral ventricle a considerable extravasation of recent fresh, lumpy, black blood, which had entered by a rent between the optic thalamus and the corpus striatum from the adjoining hemisphere. In the right corpus striatum a narrow longitudinal cavity was discovered, lined with a dark brown membrane, and surrounded by cerebral tissue, which was rather indurated. The arteries of the base of the brain were for the most part incrusted.

The brain of a woman is preserved in the Berlin museum, (No. 5763,) who suffered from fits, and during their attack always fell forwards. A steatomatous tumour was found in the middle of the pons Varolii.

2. *Backwards.*—Under this head, we include the backward-movements of the body. Friederich Hoffmann[1] mentions the case of an epileptic patient who ran backwards before the fits, in the following words: 'dum adhuc sibi constant sensus, junguntur vehementes præcordiorum anxietates et vomendi conatus, turbatis vero jam sensibus, discurrit cancrorum in modum retrorsum, atque tum subito in terram concidit.' Serres[2] also alludes to an epileptic girl of 12 years of age, whose fits succeeded one another very rapidly; and who, when they came on, was seized with an irresistible desire to walk backwards, the head being retroverted. If the head was prevented bending back, the walking in this direction was arrested; the girl completely recovered. Taube,[3] in his history of ergotism, relates the case of a patient whose body was pushed back two or three times during the spasmodic attack. When seized by the malady, he was not exactly bent back or extended with his head and shoulders, but the entire body was quickly, and several times in succession, pushed back, as if some external force were acting upon him. An entire change of place and position was thus effected; I have often seen this myself. Each time, when the patient recovered his consciousness, he inquired what was being done with him; he never was able to remember what had happened during the fit. In Casper's Wochenscrift für die gesammte Heilkunde, (1837, p. 264,) Dr. Schubert communicates the case of a peasant boy, of 17 years of age, of healthy appearance, who was suddenly attacked with great anxiety and oppression, got very red and hot in the face, lost his speech and consciousness, and then commenced walking backwards. He recovered, after the use of general and topical abstraction of blood, cold affusion to the head, purgatives, and the friction of the nape of the neck with ointment of tartrate of antimony. Latterly, he was only now and then attacked with slight and passing seizures, and then after sunset. In the sixth volume of Magendie's 'Journal de Physiologie,' we find the account of a soldier, who, in consequence of sabre cuts received on the occiput, was seized with an uncontrollable desire to walk backwards; and as often as he went

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[1] Consultationes et responsa Medicinalia, cent. ii, sect. iv, Case CLI.

[2] Anatomie comparée du Cerveau, vol. ii, p. 628.

[3] Geschichte der Kriebelkrankheit, p. 121.

from his own bed to that of a neighbour, he placed his feet from before backwards. He died on the thirteenth day after the injury. The cerebellum proved to be converted into a white pulpy mass, the cerebrum and spinal cord being normal. The following case has come under my own notice.

C. B.—, æt. 62, a silversmith, was attacked six years ago with lacerating pains and loss of motility in the thumb and forefinger of the right hand, extending up the forearm and humerus, and forcing him to give up his employment. A year later he suffered from dysentery, after which his paralytic affection increased, and the leg of the right side also grew weaker. Pains in the occiput and the spinal column extending from the cervical to the lumbar vertebræ supervened, and with these there was a tendency to fall backwards. The pains in the arm yielded to anæsthesia, which, especially in the head and the fingers, attained such a height that he did not feel deep punctures or burning. The skin became dark red and livid. The left hand continued unaffected, with the exception of formication at the tips of the index and middle fingers. The year after the patient applied to me for advice. The point that first attracted my attention was the constrained posture of the strong built man; he bent forwards, and was unable to erect his head, neck, and trunk into the upright position, without at once tumbling back, and, unless he was supported, falling upon his occiput. He endeavoured to counteract the constant vertiginous sensations and the movements by throwing his whole force into this position, and assuming, as it were, a sailing gait in walking through the streets. His organs of special sense and the state of his mind were in no way affected. Nor was there any deviation in the egestive functions, but his sexual energy was extinct, and his testicles, the left especially, proved, on examination, to be atrophied, a point that the patient had himself noticed some time previously. All attempts at treatment were futile. The vertiginous movement increased to such an extent, that he frequently injured his back and occiput by his falls; he would often totter backwards from the window to the opposite door, and then sink. About this time I repeatedly presented him to the students who attended my lectures, many of whom may yet remember him. During the last two years of his life the paralysis increased; complete paraplegia was established, and there was much tremor of the hands and contraction of the flexors, especially of the flexors of the fingers. The loss of sensibility affected the upper more than the lower extremities. The head and trunk were bent forwards, the chin almost touched the sternum, and great force was required to raise the head. Fatuity supervened; the utter helplessness and the involuntary evacuations of the patient, who was excessively poor, rendered it necessary to admit him into the Charité, where his death ensued a few weeks later, being accelerated by gangrene from decubitus, at the sacrum, the shoulder-blades, and trochanters. The section at which I was present, yielded the following results: there was sero-albuminous exudation between the arachnoid and pia mater, serous fluid in the ventricles, and incrustations of single cerebral vessels; the cerebellum was of a large size compared with the cerebrum, the surface of the former appearing depressed, as if it had sunk in; there was much fluid in the spinal canal, and the vertebræ were softened at several points. Although the post-mortem examination did not confirm my diagnosis of a tumour at the base of the cerebellum, in the vicinity of the medulla oblongata, it is probable that some degeneration of the kind would have been discovered on a more minute anatomical investigation; but owing to the unfortunate absence of Professor Froriep, the superintendent of the pathological department of the hospital, this was omitted.

Vertiginous Movement with a Lateral Impulse.

Circular or semicircular rotations have been observed to occur both after injuries of the head and diseases of the brain. Petit[1] reports the case of a soldier, who remained alive for forty-eight hours after the passage of a musket-ball through the left hemisphere of the cerebellum, to the posterior lobe of the cerebrum. He was frequently delirious, and constantly turned in bed from one side to the other, at the same time raising his arms and legs. A similar case is related by Saucerotte:[2] a soldier fell backwards down a steep staircase, and fractured his left parietal bone; he kept rolling round and round in bed, so that it was impossible to apply any bandage. After death the tentorium was found eroded on the right side, and there was considerable accumulation of pus on the cerebellum. Dr. Krieg has communicated a case in which a boy of 11 years of age was struck by a horse on the left half of the os frontis, and lived seven days after the accident, but in perfect sopor and unconsciousness. On the third day after the injury the parents noticed the following remarkable phenomenon, which recurred very frequently in the presence of Dr. Krieg. Whenever the seat of injury was touched, or the patient struck the parts that had become inflamed by counter-irritation, blisters having been applied to the cervix and sinapisms to the calves, and often without such a cause, he uttered loud and distressing cries; he then drew the feet back towards the trunk, laid his hands with extended fingers now upon the thorax and now upon the back, and supported only upon his knees and elbows, his body being suspended in the air, turned round repeatedly upon his own axis; the gyrations were from the left to the right, and they were effected with such force that two persons could scarcely hold him, and with such rapidity that he once made nineteen rotations in eight minutes. If restrained by force he screamed out loud and anxiously, and continued the rotations as soon as the impediment was removed. A judicial post-mortem was made, and showed that the cranial bones, which were thick and strong for the boy's age, were uninjured; a few small hæmorrhagic spots were found between the pia mater and the brain, on both posterior lobes, and upon the right hemisphere of the cerebellum. On removing the dura mater from the base of the cranium, the anterior edges of both small alæ of the sphenoid bone, were found torn from the orbital plate of the frontal bone by a separation of the suture; both were separated about half a line, and the extreme points of both alæ minores were broken off.

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[1] Prix de l'Académie Royale de Chirurgie, vol. iv, p. 549.

[2] Loc. cit., p. 423.

We owe the following interesting instances of rotatory spasms to Dr. Belhomme.[1]

Miss G—, aged 60, had been attacked in her 47th year, after a violent mental affection, with giddiness and weakness of the lower extremities; one day, while at a public place, she was seized with a fit lasting half an hour, in which she was forced to turn round. In 1830 the political disturbances again gave rise to similar attacks, during which she turned to the right side; at first they returned once a week, but subsequently she had them four or five times every day. Her judgment became impaired; she fancied that she had a serpent in her abdomen, and that she was destined for the scaffold. The remedies that were tried had no effect. In 1837 she came under the treatment of Dr. Belhomme. Her fits were ushered in with the following phenomena: she was suddenly deprived of consciousness, the limbs became contracted, and, owing to the flexors predominating over the extensors, she was doubled up. In this sitting position she would, even upon the edge of a chair, gyrate with extraordinary rapidity, and chiefly to the right; continuing her movements until she met with some impediment. Occasionally the rotations took place to the left, but then they were less enduring. The muscles of her face were contracted, the eyes dilated, the pupils large and immovable, there was divergent strabismus, and the eyes did not blink when a finger was held up before them. The attacks lasted from fifteen to twenty minutes, and as they ceased, the patient uttered a low cry resembling *ahooah* and recovered. During the latter years the attacks recurred very frequently, happening as often as twenty times in one day, with great violence. Pharyngeal spasm supervened. The insanity diminished as the rotatory movements increased, and *vice versâ.* In April, 1838, a bronchial catarrh supervened, and on the 18th April death ensued suddenly. At the post-mortem examination two exostoses of the size of a hazel-nut were found in the inner surface of the occipital bone, at the sides of the basilar groove, narrowing the fossa. The tumour at the left side was larger than that on the right. On removing the dura mater which covered them, and was thinned, they presented a wrinkled appearance. On each side of the crura cerebelli, and especially on the left, there was a marked impression, corresponding exactly to the exostoses. They presented a greyish colour, and their consistency was softer in the vicinity of the pons Varolii. This organ was about one third smaller than usual, and its transverse section showed a semilunar injection, both ends of which were turned towards the cerebellum. The corpora quadrigemina, especially the anterior pair, were very small, and softened in texture. The walls of the fourth ventricle were grey, soft, and disorganised; the calamus scriptorius was scarcely to be distinguished. The thalami optici were normal, the corpora striata small and flattened. The left middle lobe of the cerebrum was more voluminous than the right, whilst the right hemisphere of the cerebellum was larger than the left. The optic nerves looked atrophied. The fifth nerve of the left side was softened, and was easily detached at its insertion.

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[1] Considérations sur le tournis chez les Animaux et chez l'Homme,—in the 'Troisième Memoire sur la Localisation des Fonctions Cérébrales et de la Folie;' Paris, 1839, p. 424.

I may here refer to the history of a patient of mine suffering from facial neuralgia, (see vol. I, p. 37,) who, during the last year of his life, was affected with vertigo, and an inclination and rotation of the body to the left side; in him the left peduncle of the cerebellum was softened and congested, while the right was normal. Several patients of this description have recently come to my notice; but they presented no paralysis of any portion of the body, by which the rotation of the symmetrical statics might be disturbed. At this moment a girl of 26 years is under my hands, who presents the most undoubted symptoms of cerebral disease, and whatever position she may assume, she is pushed over to the right side, and this sometimes happens with such force that she is obliged to seize hold of some object to support herself. The extremities of the same side are in the undisturbed enjoyment of the function of motility.

Alcohol intoxication is not rarely the cause of static spasms, and especially of vertiginous movements with an impulse forwards.

Experimental physiology has succeeded not only in demonstrating the static powers, which are allied to special portions of the brain, the derangements of which are manifested as vertigo, but has also shown the seat of the power *which coordinates the movements*. Flourens[1] deserves the credit of having discovered the cerebellum to be the organ which controls the balance and consentaneousness of the movements necessary for locomotion. When the cerebellum is injured or destroyed in various animals, they lose the power of walking, hopping, flying, or climbing. By removing the superficial layers in the pigeon, the movements become feeble, and show a want of regularity. When the middle layers are attacked, the walk becomes unsteady, and can only be effected with the aid of the wings. When the last layers are destroyed the animal entirely loses the faculty of hopping, flying, walking, or standing. It is only able to sustain the erect posture by propping itself on its wings and tail. It will yet attempt to fly or walk, but there is a mere fluttering without any definite or designed movements; they resemble, in fact, the first attempts of the young fledglings when they are leaving the nest. At last the power of resting upon the legs, tail, and wings is also lost, and the bird keeps tumbling over. When placed upon its back it exhausts itself in fruitless endeavours to rise. The senses and sensation continue unimpaired; after it has become quiet, the slightest noise, the most trivial stimulus, calls forth a repetition of the restless attempts, the bird sees the threatened blow and tries to avoid it, it seeks to escape, but is unable to do so. There is a possibility of effecting consentaneous movements, but the faculty of combining them to a definite end is abolished. These observations have been confirmed by Hertwig and others, who have repeated the experiments in the most positive manner. The link yet wanting was the proof derived from the converse state of things, the exaltation of this peculiar power of coordination. Experiments instituted in animals afford no clue to this point; but morbid conditions present us with phenomena, which may be interpreted physiologically by reference to the views we have been advocating, and it is to these that I would apply the term co-ordinated spasms.

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[1] Sur les Propriétés et les Fonctions du Système Nerveux; Paris, 1824, p. 77.

CHAPTER XXIX.

SPASMS FROM EXCITEMENT OF THE BRAIN.

CO-ORDINATED SPASMS.

Gesticulations and locomotive spasms occur paroxysmally, varying in regard to time, space, and intensity, rarely isolated, and most frequently complicated with other cerebral affections.

The forms of the disease are as manifold as the combinations of the motor fibres in the central apparatus, that are effected in exciting the muscular groups to motion, may permit; and, we accordingly find, that every variety of movement which may be excited by the will occurs in the co-ordinated spasms. The patient, however clumsy and awkward he may be at other times, is seen during the attacks to possess an increased and even exaggerated power of equilibrium; he hops, jumps, climbs, swings, and performs these movements with extreme rapidity, and with frequent variations; many of the cases reported have undoubtedly been exaggerated, but some remarkable instances have been recorded by thoroughly trustworthy observers.[1] However great the exertion, it appears that a sense of great fatigue rarely follows, although these movements last much longer than any produced by an effort of the will.

The co-ordinated are frequently complicated with static spasms, or pass into one another, a circumstance that need excite no surprise, as both rest upon the same basis. A case of this kind has been described by Dr. Watt[2] with extreme minuteness. The disease affected a girl of 10 years of age, and commenced in the month of January, with violent headache, vomiting, loss of speech, and an inability to assume any other position of the body than the erect posture, from the time she awoke until she went to bed. At the beginning of February rotatory movements supervened, she turned round like a top from morning to evening with extreme rapidity, and in the same direction, and felt unwell as soon as the movements were interrupted. They ceased at the end of the month, and the headache now returned with great violence. A fortnight later such debility showed itself in the muscles of the neck, that unless supported the head fell on one side, forwards or backwards. The pain in the head then ceased, and speech returned; but at the end of March a new rotatory movement commenced, she rolled from one end of the bed to the other, or even along an entire avenue in the garden; sudden affusion of cold water did not arrest her, and once when she was laid at the side of a shallow rivulet, and the water played upon her, she made no attempt to escape, but continued her gyrations as if she were in a bath. Her arms were not affected, but were frequently extended rigidly, as in tetanus. At times the entire body became stiff for an instant, and the rotatory movement ceased, but returned again directly after. From time to time her respiration became much impeded, and sometimes she effected from twelve to twenty gyrations without breathing. A month and a half passed without any change in the symptoms, towards the end of April a new series of phenomena took place; she would lie on her back and almost bring her head and heels together, so as to form a complete arch, then suddenly relax the position and fall down upon the bed with great violence; after a brief interval of rest, she resumed the same movements. She repeated this ten or twelve times in the minute, at first for six, and at last for fourteen hours daily. After five weeks another change took place. Supporting herself upon her knees and elbows, she pressed her occiput upon the bed and then raised her trunk and legs to the ceiling, allowing the entire weight of the body to rest upon the cervix and shoulders. As soon as she had effected this, every muscular action ceased, and she fell back upon the bed like a corpse. She immediately resumed her position, and this was repeated from twelve to fifteen times in a minute, for fifteen hours every day, from 8 a.m. to 11 p.m. The father then took her out of bed and held her firmly on his lap. At first she resisted violently, but she gradually became pacified, and took a little nourishment, which she also did in the morning before the attacks supervened. At the request of the medical attendants the father also took her out of bed in the course of the day and held her, but she struggled in the most terrible rage; former attempts of this kind, accompanied by threats and castigation, had availed nothing. When left to herself she continued her movements beyond the usual time, and even through the entire night. In order to remove every suspicion of simulation, the room was darkened in the morning, and the candles lit as if it were night, and everybody was ordered to withdraw; but this had no effect. On one occasion, when Dr. Watt visited her in the morning, between seven and eight o'clock, he found her sitting upon her father's lap, she was quiet, but so shy that he was unable to see her face. The pulse was regular, and about ninety. A few minutes before the usual occurrence of the paroxysms, she became restless, the head turned in various directions, the features became distorted, the lower extremities twitched and contracted; at last she began to kick about and to resist her father, and upon his laying her upon the bed the paroxysm at once commenced. There was obstinate constipation, and emaciation, the skin was harsh and dry, and the temperature of the extremities reduced. Although consciousness continued during the paroxysm, the intellectual faculties presented features resembling those of chorea. The remedies hitherto used (cold baths, leeches, and an issue,) produced no effect. An attack of diarrhœa, which supervened, was accompanied by an improvement in her condition, which was more and more established by the continued employment of purgatives. When she had entirely recovered, she exhibited a reluctance to speak of her illness, but several expressions proved that she distinctly remembered what had occurred even when the disease was at its height.

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[1] See Wichmann; Ideen zur Diagnostik, 2d ed., vol. i, p. 144.—Thilenius; Medic. und Chirurg. Bemerkungen, vol. ii, p. 10.—Wicke; Versuch einer Monographie des grossen Veitstanzes und der willkührlichen Muskelbewegung, pp. 120—129.

[2] Medico-Chirurgical Transactions, vol. v, pp. 3—19.

Co-ordinated spasm occasionally enters into a combination with chorea; of this, I have met with an instance in a boy of 6 years, who was occasionally attacked with an irresistible desire to climb, in spite of every impediment; in the intervals he was affected with chorea.

Consciousness is rarely quite unaffected in these spasms; so that the patients are able to render an account of the impulse that induces the movements, and which they are unable to resist. A case of this kind has occurred in the Policlinik, which is under my direction, and has been observed during several years by Dr. Franque, who undertook the management of it, and has minutely and accurately described it.[1]

"Louisa A—, at present 16 years and a half old, enjoyed perfect health till the month of November, 1845. She had passed through the ordinary infantile diseases, and her physical and intellectual development was in every way normal. The parents, however, frequently observed her to grind her teeth while asleep, and to stretch herself, during which act the body was drawn backwards. In November, 1845, she was seized with general debility, which was particularly marked in the lower extremities; headache and a sense of heat also supervened. She was unable to support herself any longer on her feet, and she was forced to keep her bed. The mother observed twitchings to occur in the limbs at night, and, after a time, they also showed themselves by day. At the commencement of March, 1846, these twitchings passed into complete opisthotonus, which even at that time attacked the patient on alternate days, during the forenoon. At the same time, the parents observed that the intellect of their daughter was different during the attack from its condition during the free intervals.

"In the month of March the scene suddenly changed, and the disease entered its second stage. A series of attacks and phenomena developed themselves, which were carefully watched by gentlemen attending the Policlinik, by which means every suspicion of any simulation was removed. An aura announced the paroxysm between twelve and one o'clock in the day. The patient felt its approach, was seized with great anxiety, and begged to be undressed. Violent respiratory spasms supervened; rapid stertorous inspirations alternated with low cries and short moanings, and slight twitchings of the arms were also observed. Suddenly the patient appeared to become, as it were, wrapt in her thoughts, rolling her eyes about, or staring at an object; she would suddenly jump out of bed with great rapidity, advance with a firm step, and then sink down into a sitting posture with cracking knees. She started from this position with agility and facility, walked about, and seized various objects, which she held obstinately, or threw violently on the ground. Again, she would lie down on the ground and lie still for a time, with a very irregular pulse. At times she went to the door or the window, shook it with enormous force, stamped upon the ground, attempted to climb up the walls, or to blow away the dust from the floor, clapped her hands, and at last threw herself on the bed, where she lay tossing about. This formed the prelude to the actual fit. The patient sat up in bed, was thrown up three or four times, and again sank down. Suddenly, however, she stood up in bed, and leaped up four times with astonishing force to the ceiling of the room. The father, a robust labourer, was scarcely able to restrain her. Exhausted by these efforts, she would sink down, but immediately after leave her bed, and gyrate six or seven times round the room with excessive velocity, turning from left to right. She sometimes touched objects that stood in her way, and while continuing her movements, called to her father to remove them. Then standing on the same spot, she turned like a spinning-top, and after doing so four or five times, exclaiming "father!" sank into her father's arms, faint, with drooping eye and violent palpitation. Soon after she tore from him and resumed her circular course, repeating it four or five times, and invariably terminating with the spinning movement. This concluded one serial. She now again exhibited the behaviour described as occurring with the aura; and, after a time, the second serial commenced. The number of these serials, taking the entire phenomena from the first start into the sitting posture to the last spinning movement, was not always the same; it was never less than thirteen nor more than twenty. These symptoms were all repeated daily from March to the beginning of September, and continued from two to half-past six o'clock on one day, to two to six o'clock on the succeeding day. After September, they occurred only on alternate days, but still at the same period. The optic nerve executed all its functions, the patient recognised every object, and even caught at her books. It is not stated at this time whether she was able to read. Her hearing was very acute; she heard the most gentle movement, and directed her head to the side from which the sound came.

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[1] Deutsche Klinik, December, 1849, No. 5.

The most trivial noise made her start; the sound of anybody drinking was peculiarly objectionable to her. The power of speech sometimes, but not always, failed her. She often emitted shrill screams, and was subject to spasmodic laughing and crying. She suffered from visual and auricular phantasms. She would then give a sudden shout, grasp at the spectre, and address them; the image which generally presented itself to her was that of her deceased mother. She invariably mentioned the number of serials that she would have to go through beforehand, and has never made a mistake. If unable to speak, she told them off on her fingers. In the same way she predicted at the time that they would only attack her on alternate days. Her clairvoyance did not, however, extend further than this. The patient placed this force that drove her about, external to her body. She has often uttered the expression: 'I am drawn with such velocity that I can scarcely follow.' After the attack had passed off there was no refreshing sleep or extreme fatigue; on the contrary, after the lapse of an hour, she left her bed, was able to stand and walk, and even went considerable distances. The nights were generally quiet; she slept soundly; but still, even on the free days, she was unable to walk before seven o'clock in the evening."

"The treatment which was commenced at the Policlinik on the 23d of October, and continued to the 22d of November, in no way affected the phenomena. On this day the attack commenced at half-past one; she however only went through one series of movements, and instead of the following serials the opisthotonoid contractions ensued, which occurred four or five times from then to three minutes. The patient had predicted that this day's paroxysm would be shorter than usual, and this was the best evidence of clairvoyance. For some days previously she had only been able to state when the *last* attack had commenced. The patient was able to leave her bed at six o'clock; and from this date the attacks became continually shorter, until, in the second half of December, the afternoon attacks entirely ceased, and the disease entered its third stage.

"In the same manner as at the first commencement of the malady, the opisthotonus occurred in the former on alternate days, and in addition to this there were violent convulsive movements every evening between eight and ten o'clock, which in no way differed from ordinary chorea. Both paroxysms were attended by psychical excitement, and both were preceded by an aura. The patient felt in a state of discomfort, and was sullen and cross. The attacks commenced with a few long-drawn inspirations; those of the evening passed into sleep, whilst those of the morning presented a peculiar termination. In the evening paroxysms the spasms resided in the muscles of the trunk, neck, and cervix, the left side being more affected than the right. The facial muscles seemed to be unaffected, unless we lay a stress upon the frequent corrugation of the forehead. The eyes preserved their usual brightness, though they were sometimes rigidly fixed upon one point; the pupils were much dilated, and the complexion presented no alteration. At times the respiratory muscles were violently affected; she breathed rapidly, hastily, and anxiously; there were long-drawn inspirations only at the commencement and termination of the attack; no yawning was ever observed, but there was often a short moan. The patient, who was silent and perverse at the commencement, gradually became joyous, petulant, and naughty towards her parents, for whom at other times she had the greatest affection. While in this condition, she had the greatest repugnance to every kind of occupation. I have never been able to induce her to read or to knit; she would hold the book upside down, draw the knitting needles out of the socks, and throw the work on one side.

"Her remarks were rational, and in no way beyond her station in life. During the attack she remembered everything that had occurred previously, but in the free intervals she only had a dreamy recollection of what had occurred during the paroxysms. The patient was excessively timid, and clapping the hands caused a violent start of the entire body, even if she saw it done. The evening attack supervened earlier, if she had been affected by any emotion; it intermitted entirely while she was in the open air. I have, however, seen that it occurred instantly upon her entering the room. All the symptoms hitherto described were also witnessed in the attacks of the forenoon, except that the movements were more violent; and that every third minute during the continuance of the paroxysm, there were tumultuous movements of nearly all the muscles of the body. The patient then suddenly, after a very quick inspiration, pressed the occiput upon the pillow and her feet upon the mattress, whilst the rest of the body was jerked up a foot or a foot and a half, and then fell down heavily. The hands were either held before the face, or also helped to give the impulse. The upwards movement was effected twice in rapid succession. No pain seemed to be induced; on the contrary, the patient talked and laughed. An attempt to prevent the movements gave rise to a piercing scream, and the most violent struggles to obtain her liberty, to which it was necessary to yield. The attack at this period commenced at ten and continued till eleven. The patient then fell into a sleep, lasting about one minute, took two deep inspirations, seized her father's hand, which she squeezed with each inspiration, and then recovered herself. All these phenomena disappeared entirely in the summer of 1847; the girl seemed to be restored to health, no trace remained, except a disinclination to rise early in the morning. In the autumn of the same year they returned as before. In the winter of 1847-48 the ordinary movements of chorea took the place of the opisthotonus, so that the morning attack was no longer to be distinguished from that of the evening.

"In February, 1848, the opisthotonus returned on alternate days. At this time, by a careful investigation of the spine and cranium, a small spot was found on the vertex, which, when touched, excited an unpleasant sensation in the patient. She was unable to describe the character of the feeling, but she stated distinctly that it was not pain. This spot is as sensitive during the attacks as at other times. Pressure applied here during the morning paroxysms induced opisthotonus, accompanied by violent respiratory movements. The patient was unpleasantly affected by the mere approach of the hand. The summer of 1848 elapsed, the girl suffering in various ways, and the paroxysms continuing unabated. In consequence of the political riots that disturbed Berlin, and the attack upon the arsenal, she lost her speech, and her intellectual faculties were entirely prostrated. Thus, she would pour the coffee upon the table instead of into the cup; she attempted to cut with the fork instead of using the knife. Her features were sunk, her face pale, the eyes staring, distorted, and prominent; the pupils very much dilated, the vessels of the sclerotic coat congested in parts, and the choroid shone through with a blueish tint. She took no notice of various questions addressed to her. When the palms of her hands were tickled she exhibited some reaction, and gradually showed more consciousness of what was going on around her. Pressure applied to the above-mentioned part of the head induced violent spasms; after which she was able to utter a few words, but soon ceased. On repeating the experiment, she recovered her speech for a quarter of an hour. Her attempts to speak were unavailing, however much she laboured to do so, at the same time she was able to laugh out loud and to move her tongue freely. After a few days this condition disappeared, and returned several times subsequently. The general state of health of the patient varied from time to time. She complained chiefly of general debility and headache. Nevertheless, her physical and intellectual development proceeded satisfactorily; and in June, 1848, after a tolerably copious leucorrhœa had preceded, the first traces of menstruation presented themselves. In the month of December menstruation was fully established, though accompanied by great sufferings. The attacks of opisthotonus continued with very slight intermissions for three days, and they were more violent than usual. At the same time there were febricitations, she was unable to speak, and was completely apathetic. The menses had since occurred with perfect regularity, and although the paroxysms have not ceased, they have lost something of their violence. The body, which was wont to fall back upon the bed with its entire weight, now sinks back slowly, as if the force were broken. All other spasms have entirely ceased, and nothing remains in the evening but a state of excitement. The spot on the vertex continues equally sensitive. Physically the patient is completely developed, and is able to walk long distances without being fatigued. Her intellect is also healthy. Her memory has not suffered in the least; her powers of perception are vigorous, but she wants perseverance either for bodily or mental occupation. In the month of September of the present year she suffered from cholera; during this time the attacks ceased; after her recovery from the intercurrent affection, the fits returned as formerly."

The female sex is almost exclusively liable to this disease; it occurs most frequently at the period of the development of puberty, but also subsequently if there be an hysterical constitution. Mental emotions often act as exciting causes; intestinal irritation may at times be shown to exist.

The prognosis is favorable. The malady rarely passes into epilepsy or insanity. The spontaneous cure is generally retarded by inconsiderate interference, or over-busy activity on the part of the medical attendant, or still more on the part of medical dilettanti. In employing moral agents, we must avoid terrorism; it is advisable to secure seclusion, by which all stimuli of vanity, of simulation, or of curiosity are avoided. If there be anæmia and debility, the careful employment of preparations of iron, invigorating diet, and especially the influence of fresh air, is to be recommended. The patient whose case has been above detailed was treated in this way, and has recovered entirely since the month of September in 1850. We must not neglect to attend to critical processes occurring in the uterine intestinal and cutaneous systems. Derivations to the intestinal canal have shown themselves beneficial in several instances. The advocates of the so-called animal magnetism have rather pandered to a fashionable taste, than that they have obtained any beneficial results.

It is not only the locomotive movements, but also those of articulation which require co-ordination, or some adaptation in the nervous centres by which the excitement of the nerves and muscles, requisite for the production of articulate sounds, is rendered possible. This is the pre-established harmony existing between the subjective intelligence and the organs of speech, which is variously interrupted in morbid states, whether by convulsive or paralytic influences, or by abnormal excitement of the co-ordinating faculty; when the latter is the case, we find that articulating movements are produced like the movements of locomotion, in single sounds, or in a certain series, as syllables or words without any mental act, or even against the will of the patient. Thus I have often met with the phenomenon accompanying cerebral hæmorrhage, in which the patient intends to utter a certain word, but emits a different one. A gentleman, distinguished by rank and education, once assured me, that of the various inconveniences and troubles following an apoplectic seizure, none was so painful to himself as the fact of his applying wrong terms (such as water for wood and the like) to express his meaning, and the suspicion of insanity which he thus excited among his friends. Dr. Bright[1] describes the case of a girl of 18 years of age, who, in consequence of depressing mental emotions, was obliged to sigh involuntarily and very frequently. This passed into a spasm, during the continuance of which she every three seconds uttered a sound like *heigh-ho,* which she sometimes changed into *heigh.* She was only able to control the sound for a short time, if, for instance, she wanted to say a short sentence, but she was unable to combine two or three sentences, without being interrupted by that exclamation.

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[1] Reports of Medical Cases, vol. ii, p. 458.

CHAPTER XXX.

SPASMS FROM EXCITEMENT OF THE BRAIN.

PSYCHICAL SPASMS.

We turn from the consideration of cerebral spasms, which are manifested as twitchings, and are produced by the indirect influence of cerebral irritation upon the motor tracts, or as co-ordinated and vertiginous movements by the direct excitement of definite portions of the cerebrum, to spasms which are under the influence of the brain, as the organ of the mind. The mind is manifested by movement in disease as well as in health, and it is only from overlooking this law, that we are induced to suspect either a miracle or a deception. The stimulus of mental impressions may produce spasms, to which we apply the term, psychical spasms.

The perception of spasmodic movements, whether induced and kept up by impressions on the senses or by recollection, by the real or supposed presence of the object, induces spasm, which is manifested as a twitching or co-ordinated movement in subjects who labour under excitement of a physical or moral character.

Without any intention on the part of the individual, or even against his will, movements of a spasmodic character take place when he sees or hears descriptions of such conditions. We have already spoken of imitative singultus, yawning, and cough; instances of communication on a larger scale are recorded in Hecker's admirable monograph, 'Die Tanzwuth eine Volkskrankheit im Mittelalter,'[1] which is a rich mine for inquirers into this subject generally. To mention a single instance:[2] a girl employed in an English cotton mill was seized with violent convulsions, in consequence of one of her fellow workwomen having in fun put a mouse into her bosom. The patient remained in the company of her companions for four and twenty hours after she had become thus affected. On the succeeding day three other girls were attacked in the same manner, and on the third day six more. The advice of Dr. St. Clare was requested on the fourth day, but previously fourteen more persons had been seized, so that a total of twenty-four were labouring under the spasms. Among these there were twenty-one[1] girls, the two youngest being only ten years of age, and only one man, who had been very assiduous in rendering assistance to those attacked. Three of the girls lived at about two miles, and three others about five miles from the place where the disease made its appearance. The last three and two others had not even seen any of the patients, but had merely been attacked in consequence of hearing the account of what had happened. Besides the spasms, which lasted continuously from a quarter of an hour to four and twenty hours, and were so violent in some that they required to be held by four or five persons to prevent them tearing their hair or dashing their heads against the wall, the patients suffered from anxiety, dyspnœa, and attacks of suffocation. The cure was soon effected by electric shocks; the disease did not spread after the arrival of the physician, and six days after the outbreak of the malady, which under favouring circumstances might have spread very extensively, all had recovered. This case is distinguished by the absence of any special predisposition to spasmodic affections on the part of the affected girls, unless we look upon their impoverished health from being pent up in the workrooms of a cotton factory, in this light. There was no enthusiasm to account for it, nor is it stated that the patients had been affected by nervous diseases previously.

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[1] See Hecker's Epidemics of the Middle Ages, translated for the Sydenham Society by B. G. Babington, M.D.; London, 1844.

[2] Ibid., the Dancing Mania, p. 140.

When there are other influences at play, the most powerful of which are religious fanaticism, and the arrested intellectual growth of the nation, psychical spasms are manifested with epidemic violence, or with endemic pertinacity. Thus the dance of St. John[2] spread in the year 1374 from Aix-la-

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[1] [Twenty-one is the number given in the original; but whether this is a misprint, or whether two persons who are not accounted for were married women, is not stated.]—Ed.

[2] Hecker's Epidemics; the Dancing Mania, Dr. Babington's transl., p. 87.

Chapelle to Cologne, and continued under the name of St. Vitus's dance until the commencement of the sixteenth century. In the eighteenth century the convulsionnaires appeared in France,[1] and even in 1814 an epidemy of convulsions occurred in Cornwall, excited by religious fanaticism and accompanied by ecstatic phenomena; in a brief period as many as four thousand individuals of all ages were attacked; children of five and six years, and old men of eighty were attacked, though the majority were girls and young women.[2] A few years ago, a similar epidemic occurred in the north of Sweden. An instance of the endemic spread and propagation of psychical spasms is met with in the northern parts of Scotland, where the disease is known by the name of the leaping ague. The attack is ushered in by headache and pain in the loins, upon which fits of hopping or leaping supervene. Sometimes the patients run with extreme velocity over dangerous ground, and then sink down exhausted. In the huts which they inhabit, they climb up the walls, swing round the beams supporting the ceiling, or jump from one to the other with the agility of a cat.[3]

Among the sensual impressions which excite psychical spasms, we must especially mention the organ of hearing. Thus the influence of music upon spasmodic movements shows itself in the rhythm of the dance. An instance on a large scale is afforded by the history of tarantism, a popular disease, which attained its height in Italy in the seventeenth century, and of which Hecker[4] has given an account, which is as spirited as it is critically correct. Among the sporadic cases recently detailed,[5] the one communicated by Wood[6] in the 'Medico-Chirurgical Transactions,' is remarkable for the accuracy of the description. The imitative movements of articulation in disease have not hitherto been the object of investigation. A singular phenomenon, which I should be inclined to call the echo, has repeatedly occurred to me in various morbid conditions of the brain. The patient, in a monotonous way, repeats the words and sentences spoken by somebody in his vicinity, without showing that his attention has been attracted, or that he associates any meaning with what he is articulating. A lady who died of softening of the brain, invariably repeated my questions, as, "show me your tongue," or "will you lift up your arm," without doing as she was bid. I am acquainted with an idiot of 11 years, who in this way mimics music in a remarkable manner. The same phenomenon has occurred to me in two young girls labouring under typhus fever, when the disease was at its height.

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[1] Le Naturalisme des Convulsions dans les Maladies de l'Epidémie Convulsionnaire, of which Hecquet is the author; Soleure, 1733.

[2] See the Account by Cornish, in—Nasse's Zeitschrift für Psychische Aerzte, vol. i, p. 255.

[3] Edinburgh Medical and Surgical Journal, vol. iii, p. 435.

[4] Dr. Babington's transl., p. 107.

[5] See—Nasse's Zeitschrift für Psychische Aerzte, 3 Jahrg., p. 609.

[6] Vol. vii, pp. 236—256.

CHAPTER XXXI.

SPASMS FROM EXCITEMENT OF THE BRAIN.

EPILEPTIC CONDITIONS.

The converse of the cerebral spasms hitherto considered, are those which are associated with an arrest of consciousness, and have from time immemorial been comprised under the term of epilepsy.

Nobody has hitherto succeeded in producing epileptic attacks in animals by lesions of the brain or spinal cord. Saillant, who was commissioned during the last century by the Académie Royale de Médecine at Paris, to investigate the subject of epilepsy, already remarks, at the close of his treatise entitled 'Expériences faites sur les Animaux pour découvrir le siège et la cause prochaine de l'Epilepsie,'[1] "Nous nous consentons de conclure aujourd'hui qu'il est plus facile de produire un accès épileptique artificiel en agissant sur le sang que sur les nerfs et le cerveau;" however his experiment of injecting atmospheric air into the jugular vein of a horse is unsatisfactory, as it merely induced fatal convulsions. The experiments conducted by Sir Astley Cooper[2] were much more valuable. On tying both carotid arteries in a rabbit, respiration became somewhat accelerated, and the heart's action increased, but no other effect was produced. Five minutes later the vertebral arteries were compressed with the thumbs in such a manner as not to affect the trachea; the respiratory movements were almost instantaneously arrested; convulsive fits ensued; the animal became unconscious, and seemed dying. The pressure was removed; the rabbit recovered its consciousness after a convulsive inspiration; lay on one side; made some violent spasmodic efforts; breathed heavily, and the heart's action was powerful. After two hours it had recovered, except that respiration was still laboured. The vertebral arteries were again compressed; respiration was arrested, convulsions, a cessation of movements and apparent death followed. The fingers being relaxed, the animal recovered with a loud inspiration, but breathed very heavily. After four hours it ran about, and munched some greens; five hours later, compression was again applied to the vertebral arteries, and with the same result; after seven hours, it was cleaning its face with its paws; after the lapse of nine hours, the vertebral arteries were compressed a fourth time, and the effect was the same; thirteen hours after, the animal had recovered itself; four and twenty hours later, the experiment was repeated, and the result was arrest of respiration, convulsions, and unconsciousness; after removing the compression, there was violent and laborious respiration, followed by very rapid inspirations. The compression was applied a sixth time, after a lapse of forty-eight hours, and the phenomena were the same. Thus it appears that after applying ligatures to the carotids, mere pressure upon the vertebral arteries is sufficient to arrest the functions of the brain completely, and to produce convulsions. Very recently Marshall Hall[1] has attempted to show that unconsciousness and the whole train of psychical disturbances occurring in an epileptic paroxysm, is owing to a compression exerted by the contracted cervical muscles upon the subjacent veins, and to the impeded return of the blood from the brain, but no proof is given that such compression is really effected by the spasm of the individual muscles of the neck; that, for instance, the internal jugular vein is compressed by the sterno-cleidomastoid and the omohyoid, or the vertebral vein by the scaleni. The time has passed when we can rest satisfied with a mere hypothesis, however attractive it may appear. In hysterical paroxysms, and in the convulsive throes of tetanus, there is no unconsciousness; on the other hand, in the abortive forms of epilepsy, the psychical disturbances prevail, while scarcely any convulsive action is manifested.

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[1] In Histoire de la Société Royale de Médecine, ann. 1782-83, pp. 88—96.

[2] Some Experiments and Observations on tying the Carotid and Vertebral Arteries, &c., in Guy's Hospital Reports, vol. i; London, 1836.

The epileptic states vary according to whether the altered excitability causes fatal exhaustion by one or more fits, or is restored to the normal condition, or whether it is perpetuated and becomes habitual, and then induces the necessity of a periodical repetition of the attacks. The former runs an acute course and is termed eclampsia; the latter is chronic, and is known as epilepsy.

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[1] On the Neck as a Medical Region, Lancet, 1849, Nos. vii and ix; and—Synopsis of the Diastaltic Nervous System; London, 1850, p. 65.

ECLAMPSIA.

Infancy and the female sex, especially during gestation, predispose to the affection. Poisoning, parturition, the sudden irritation of sensitive parts, and inanition from loss of the vital fluid, are the most frequent exciting causes.

Eclampsia Toxica.[1]—The substances which induce the epileptic paroxysm in mankind are derived chiefly from the vegetable kingdom, œnanthe crocata, conium maculatum, cicuta aquatica, less frequently hydrocyanic acid; and in the mineral kingdom, lead, *eclampsia saturnina.* Among the older writers, Stoll has already pointed out that epilepsy is the result of lead poisoning; among the moderns, Laennec and Andral have drawn attention to the fact, but the subject has been most comprehensively treated by Tanquerel des Planches,[2] who has observed thirty-seven cases himself.

This form of eclampsia runs a course which varies in duration from a few days to four weeks, and is always connected with psychical disturbances, such as delirium and sopor, with which it alternates, and forms various combinations. The fits themselves, which are not preceded by an aura, recur at longer or shorter intervals (from a few minutes to six days), from one to thirty times in the course of four and twenty hours. The convulsions affect both sides of the body, and are more violent and of longer duration than those of ordinary epilepsy. Nor does consciousness ever return so speedily; a confusion of speech and intellect and great indolence continue for one or more days. As this species of eclampsia generally affects individuals who have long been in the habit of handling lead, we find further evidence of this fact in the yellowish or earthy complexion, the brown tinge of the teeth, and slaty colour of the gums, and the rapid emaciation. Lead colic sometimes precedes, or is developed simultaneously with this affection; it rarely follows; the same applies to the neuralgic pains in the extremities. (See vol. I, p. 155.) Saturnine paralysis is met with very rarely, and amaurosis is also of rare occurrence. The fatal issue is very common, and takes place in the proportion of one out of four cases; it results from asphyxia or apoplexy, often occurring suddenly when the fits have recurred with such frequency that an interval was scarcely perceptible. At the post-mortem examination we may find the brain presenting the yellowish, earthy, dirty hue peculiar to lead poisoning, and not unfrequently the alteration in the cerebral tissue termed hypertrophy. We then discover the gyri to be flattened and compressed, so as almost to obliterate the sulci; the ventricles narrowed; the membranes and the tissue dry; the colour pale; the consistency firm and dense, and the volume increased. It is also important that in two cases sulphate of lead has been found in the brain. In the majority of cases, however, the brain and spinal cord present no appreciable differences.[1] The return to health takes place gradually; the patient shows a great tendency to somnolency, and for a few days looks like a person who has just awoke from sleep. Rayer and Tanquerel des Planches recommend an expectative treatment as the one most likely to benefit the patient, as all violent remedies only accelerate the fatal issue. The employment of purgative enemata, of flying blisters applied to the lower extremities, and of cupping, assisted by a suitable diet, is preferable to the use of cold affusion, opium, or croton oil.

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[1] Consult—Wepfer; Historia cicutæ aquaticæ, Basil, 1716; and—Christison, a Treatise on Poisons; Edinb., 1836, p. 617.

[2] Traité des Maladies de Plomb ou Saturnines; Paris, 1839, vol. ii, p. 298.

Eclampsia is also induced by blood poisoning, resulting from the contagion of smallpox, scarlet fever, or from the retention of substances that ought to be secreted, as is the case in renal diseases.[2] In cases of this kind, especially when recent, it has been found that venesection, assisted by the local abstraction of blood and counter-irritation, exerts a speedy and permanently beneficial effect, as I have had the opportunity of observing in a patient of 16 years of age, who applied as an out-patient at the Hospital on the 29th of October, 1846.

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[1] Tanquerel des Planches, pp. 348—363.

[2] Addison—On the Disorders of the Brain connected with Diseased Kidneys: Guy's Hospital Reports, vol. iv, p. 1.

Eight days previously, he had suffered from trifling febricitations, followed by a slight attack of angina, dyspnœa, and tumefaction of the face, and œdema of the lower extremities, extending to the middle of the thighs. The colour and temperature of the skin were unaltered. The pulse was 104. The urine, which was scanty, turbid, and very frothy, showed a weak acid reaction, and contained much albumen, blood-corpuscles and fibrinous casts. The patient complained of tension and pain in the epigastric and lumbar regions, of repeated vomiturition, shivering, somnolency, and vertigo. The latter symptoms evidenced a perilous implication of the brain, and the fears which I had expressed were immediately after verified by what followed. As the patient left the clinical theatre, he was seized by violent vertigo and fell to the ground. He was carried home, became somnolent, and an hour after was suddenly attacked with a violent epileptic paroxysm. This lasted from fifteen to twenty minutes, and was followed by profound sopor, from which the patient awoke after an hour, to a state of semi-consciousness, in which, however, he was able to answer the questions put to him, in a tolerably connected manner. His face was crimson, the carotids pulsated violently, respiration was accelerated, the pupils dilated and insensible to the stimulus of light. The chief subject of complaint was a violent frontal headache. After the lapse of a few hours, the epileptic paroxysm was twice repeated in exactly the same manner. I ordered him to be bled to twelve ounces, to have ten leeches behind his ears, cold applications to the head, and a purgative composed of infusion of senna and syrup of buckthorn. On the following morning, consciousness was perfectly restored, and there was only some trifling headache remaining. A copious discharge of urine had taken place, with the alvine evacuations. The cold applications to the head and the purgative draught were repeated for two days. On the 2d of November, the patient passed a quart and a half of turbid urine, the albumen contained in which was not diminished. The pulse had sunk to 62. From this date, the patient was ordered cream of tartar in water, as his ordinary beverage, and the effect was so satisfactory, that on the 16th of November no œdema was left. Owing to the persistence of the albumen in the urine, the bitartrate of potash was continued. At the end of the year the patient again presented himself in the clinical theatre, and the urine was found to be normal. It has since been repeatedly examined, and the result has proved the cure to be permanent.

Eclampsia parturientium.—The convulsions coming under this denomination break out suddenly, and the patient is at once deprived of consciousness. The face and neck swell, and become red and livid. The carotid and temporal arteries pulsate violently, and the jugular veins swell; the eyelids are distended, the eyeballs are elevated or stare rigidly and their vessels are congested, or they roll about under the closed eyelids. The tongue projects, and is bitten by the grinding teeth, causing it to bleed, and bloody froth issues from the mouth. The facial muscles twitch, the limbs are curved or stretched, and again contract with lightning-like rapidity. The whole trunk is at one time rigid, immoveable, drawn backwards or to one side; the next moment it is thrown about by twitchings and convulsions, so violent that the patient can scarcely be restrained. The muscles of respiration, and especially the diaphragm, are implicated; there is danger of suffocation. Vomiting supervenes, and urine and excrements escape involuntarily. The temperature is raised, the face drops with perspiration. The pulse is very frequent, full and strong, or weak and hard. The abdomen is tympanitic; the uterus is hard, and this hardness increases as often as convulsions are renewed. The os uteri is closed, or only slightly patulous.

An attack of this kind rarely lasts less than five minutes; it generally continues for a quarter or half an hour, and occasionally extends over four and twenty hours; in this case, the spasms remit and again exacerbate, alternating or combining with apoplectic conditions. If the first outbreak is not fatal, a remission follows; consciousness returns gradually, but the patient is generally unable to remember what has occurred, even if she has given birth to a child during the attack. The pulse remains accelerated, a few muscular groups continue to oscillate, the head feels heavy and painful, the abdomen is sensitive, and there is extreme exhaustion; the eyelids then again begin to twitch, the lips tremble, the face becomes red, the head is drawn backwards and thrown from side to side, a fresh outbreak ensues, generally increased in violence, and in this manner above twelve fits may recur in one day, although it is more frequently the case that recovery or death follows after the second or third.

It is more frequent to find the disease appearing without any precursory symptoms than with them; occasionally we find headache, scotomata, vomiting, yawning, a sense of weight and pain at the epigastrium and hypogastrium, and numbness of single extremities, preceding the attack.

The *cadaveric inspections* hitherto recorded are incomplete, owing to the spinal cord not having been examined. In the cranial cavity we generally find considerable congestion, increased density of the cerebral tissue, plastic and sanguineous extravasations between the membranes and in the ventricles, in the latter chiefly when apoplectic symptoms, a profound sopor, stertorous breathing, &c., have been associated with the convulsive affection.[1] Thus, I found a small coagulum at the base of the anterior lobe of the left hemisphere, in a woman of 29 years of age, who was in the eighth month of her third pregnancy, when she was one night suddenly seized with violent headache, unconsciousness, and convulsions; death ensued twelve hours after. The uterus is generally perfectly normal.

Eclampsia makes its appearance most frequently at the approach of parturition, during its actual occurrence, and during the last two months of pregnancy; it is less common after delivery, and is met with least of all before the sixth month of pregnancy; though hysterical paroxysms have been occasionally mistaken for the severer malady. Primiparæ are more predisposed than those who have gone through numerous pregnancies and deliveries. Of forty-eight patients observed by Merriman, thirty-six were primiparæ; ten cases attended by Champion were all primiparæ, (Velpeau, ibid.) Eclampsia does, however, occur in the second, third, and subsequent pregnancy. Dumont mentions a woman who suffered from the disease at her eleventh pregnancy, (Velpeau, ibid.) Hamilton and Nagelé state, that twin-births predispose; others attribute a predisposing influence to pregnancy occurring at an advanced period of life. Plethoric, well-fed, robust individuals are liable to the affection, and Osiander, Hamilton, and others, consider œdema and anasarca to encourage it. The most common exciting causes are emotions, and particularly alarm and vexation; next in order, gastric repletion, retention of urine owing to pressure of the gravid uterus upon the bladder, local impediments in the genitals, which render the employment of instruments necessary; violent hæmorrhage and retention of the placenta. Yet, although all these causes are in frequent operation, the disease itself is of rare occurrence. My friend, Dr. Mayer, has only met with five cases during fifteen years, in the course of which he has attended 2500 labours; the celebrated midwife, Madame Lachapelle, in Paris, has only seen it 68 times in 38,000. Other accoucheurs have had a larger share; thus, in Merriman's practice, it occurred 48 times in 2000 births. Future investigations must determine whether albuminuria, which often supervenes during pregnancy, may, when fully developed during the last months, possess any etiological influence. It would be a bold assumption to ascribe any influence to the osteophyte of the cranium discovered by Rokitansky, and which is formed in every pregnancy.

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[1] See—Hauck; Einiges aus dem Gebiete der praktischen Geburtshülfe; in—Casper's Wochenschrift der gesammten Heilkunde, 1833, vol. i, p. 133; and—Velpeau, Die Convulsionen der Schwangerschaft während und nach der Entbindung. Uebersetzt von Bluff: Köla, 1835, p. 86.

The disease under consideration threatens the life of two individuals, the mother and the child; above one half of the women attacked, died within twelve, twenty-four, or thirty-six hours; the danger is greater during the last months of pregnancy than during and after parturition. When eclampsia is associated with profound sopor and stertorous breathing, it is almost invariably fatal. Plethoric, robust females are in greater danger than weak and hysterical subjects. When the intervals are very short or become imperceptible, death is at hand. Eclampsia rarely passes into other diseases. It is only in a few cases that metritis and peritonitis are developed, or that partial paralysis remains in consequence of hæmorrhage having taken place. (Velpeau.) After a favorable termination the patient entirely recovers her strength. The prognosis is even more unfavorable as regards the child than the mother; the infant almost invariably dies when the disease occurs during the last months of pregnancy; it may be saved when the eclampsia supervenes during parturition.

The most experienced accoucheurs agree as to the propriety of treating the affection by means of copious and repeated venesection. The Anglo-American school, which is renowned for the boldness of its measures, has given proof in this disease also, of the enormous loss of blood which the female organism may endure. Dewees,[1] in speaking of one of his patients, mentions that she lost 97 ounces of blood in seven venesections, and from another who recovered, 120 ounces were taken during the first hour, and 140 during the following hours. The veins of the arm are to be preferred to the veins of the foot, as it is more difficult to obtain the necessary quantity from the latter, and with sufficient rapidity. The safest internal remedy is opium; the most recent observations[2] equally bear testimony to its value when given in larger doses, from gr. ss to gr. j, and more, after a preceding venesection. The next point to be attended to, is to effect delivery in whatever way we best may. We must look upon it as our main object to save the mother, and we can do this the more confidently, as the child is either dead or on the point of dying. Obstetrics teach us the special operations, such as the artificial induction of abortion, dilatation, and incision of the os uteri during parturition, or turning, that are indicated for achieving our object in individual cases.[3] Whichever we may select, no time should be lost, nor should we allow of any delay by trying other remedies which would only prove useless. It is undoubtedly true that we are unable to save all, for half the patients die; but we have the encouragement of knowing that those who recovered owed it solely to the rapidity with which delivery was effected. Chaussier[4] recommends that we should rather apply the unguentum belladonnæ to the os uteri, but other observers have failed to see the advantage of the remedy.[5] He used the belladonna in the following form:

℞. Extr. Belladonnæ, ʒij;
Solve in Aquæ, ʒij.
Dein tere cum Axungiæ Porci, ℥j.

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[1] Compendium of Midwifery, pp. 502—505.

[2] See Schwartz; über Eclampsie der Kreissenden; Riga, 1851, p. 54.

[3] Ibid., pp. 59—64.

[4] Considérations sur les Convulsions qui attaquent les femmes encientes; Paris, 1823.

[5] Velpeau; loc. cit., p. 94.

and applies it by the aid of a syringe invented for the purpose; the os uteri, according to his statement, becomes relaxed in half an hour.

If the eclampsia continues in spite of these measures, we may yet attempt powerful derivation (especially by applying the hot hammer to the cervix), the local abstraction of blood, cold fomentations and affusions, while hot fomentations are applied to the abdomen and legs, powerful clysters of æthereal oil of turpentine, or assafœtida, or the inhalation of chloroform; but these remedies rarely avail anything when parturition, whether effected naturally or artificially, has failed to arrest the malady. Denman recommends sprinkling the face with cold water, which he has seen followed by good results in several cases. In one case in which the patient had already been bled, and other remedies had been used, he placed a basin of water before him and sprinkled water upon the patient's face with a plumeau, whenever the convulsions threatened. The convulsions were stopped each time, and only broke out once with any violence, when the sprinkling was omitted. A living child was born fifteen hours later.[1]

We are rarely able to remove the cause of the malady unless we find that there is some gastric irritation; in which case several writers recommend the employment of a powerful emetic; or in cases of hæmorrhage after parturition, when, of course, the first indication is to arrest the flow of blood, and general bleeding can rarely be adopted.

Eclampsia puerorum.—This disease is commonly ushered in by premonitory symptoms, occurring a day or two before the actual attack. The most usual are,—irritability and loss of the joyousness of childhood, restless sleep of short duration, with starting, lagophthalmus, the sardonic grin, trembling and starting when the body is touched or from sensual impressions, headache, alternate flushing and pallor of the face, a fixed state or rolling movement of the eyes. However, the paroxysm may supervene suddenly with a scream, without any precursory symptoms. The facial muscles twitch, the trunk becomes rigid and immoveable, shortly after spasmodic action supervenes, the head and neck are drawn backwards, the limbs are forcibly extended or bent, and the legs are drawn up to the abdomen. The twitchings are occasionally confined to single muscles, or in rare cases to one side, or they proceed from the abdominal muscles and ascend. At the same time consciousness and sensation are in abeyance. The staring eye sees not, passing the finger over it causes no blinking; the pupil is immoveable, dilated, or contracted; the ear is insensible to a loud noise. The pulse is small, very frequent, and often not to be counted, the breathing tumultuous, and the temperature elevated.

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[1] Marshall Hall—On the Diseases and Derangements of the Nervous System, p. 331.

After the duration of a quarter or half an hour and more, the spasms gradually cease; sometimes, though rarely, they are arrested suddenly. The facial muscles in the former case and the muscles of the extremities vibrate from time to time, while the physiognomonic expression indicates the return of the perceptive powers. The child is exhausted, and often falls to sleep more or less soundly than in health. The excretions, especially those from the intestines, are generally abnormal. Thin, greenish-yellow evacuations of a fetid or acid smell are discharged spontaneously, or after the exhibition of laxative medicines, generally accompanied with colicky pains. Several attacks commonly follow one another; in one of my own children, they returned during one night regularly every half hour as the clock struck. The more frequent they are the more violent they become, so as at last scarcely to be separated by a free interval; they then generally terminate fatally; the less frequent the fits, the more marked the interval, and the more sure and rapid is the return to health, so that the child that we left apparently moribund will be found an hour or two later playing with its toys. The fits occasionally run a regular periodic course, and assume the quotidian (rarely the tertian) type. A boy aged 5, who was brought to the Policlinik on the 10th Nov. 1846, and whose mother had suffered from eclampsia during pregnancy, had for eight days previously been subject to attacks of eclampsia, which recurred daily between four and five o'clock in the morning, and were preceded by headache. As there was a large accumulation of ascarides, purgatives of calomel and jalap were ordered, the effect of which was that no regular paroxysm occurred up to the sixteenth, but that every day at the same time headache and giddiness, and an occasional distortion of the right ala nasi and angle of the mouth, supervened. On the 24th of the month, the paroxysms having returned at the same time, one grain of the sulphate of quina was ordered four times daily; upon this they gradually abated, at last passed into a slight rigor, and on the 15th December ceased altogether. One year later the boy was affected with bronchitis, and the fits had not returned in the interval. The disease ran a similar course in a boy of twelve years, who, when first seen, had been attacked with eclampsia every evening for eight successive days; the fit was preceded by vertigo, and no appreciable cause could be shown to exist. In this instance the intervals being quite free from disease, quinine was exhibited in doses of five grains daily; the convulsions gradually disappeared, and in their place there was merely headache, vertigo, and sickness. Two scruples of quinine sufficed to restore the patient entirely.

A certain period of life, from birth to the seventh year, and especially the first period of dentition, predispose to the disease. It is undeniable that an hereditary constitution exists, for in some families almost all children are attacked with eclampsia. Elsässer[1] has recently drawn attention to a point which had not previously been remarked, viz., the softening, thinning, and perforation of the occiput or cranio-tabes, which he looks upon as the form of rhachitis peculiar to the first months of life. The osseous tissue is thinned, flexible, soft, and porous, defects being especially perceptible along the lambdoidal suture, and at the occiput, with the exception of the protuberance. The holes, which vary in number, and may amount to as many as thirty, are easily recognised by the touch, the adjoining parts are very compressible, and they feel like stiff paper, or a distended dry pig's bladder; they emit a similar sound when touched. The defects in the bone are filled up by the pericranium and the dura mater, which are adherent to one another, so that they appear to form one membrane. The symptoms that mark the affection, are tenderness of the occiput to the touch; and when recumbent, endeavours on the part of the child to escape from this annoyance induced by change of position and movement, sleeplessness, inclination to press the forehead against a firm object, quietude as soon as it is carried about in the erect position, scanty hair, and falling off of the hair at the occiput, not merely as a result of the restlessness and the friction, but also from the looseness of the roots of the hair, so that it can be pulled out easily by handfulls; there is irritability and starting, and in the majority of the children there are clonic or tetanic spasms in combination with spasm of the glottis. If these terminate fatally, as is frequently the case, a febrile condition, with symptoms of permanent cerebral irritation precede; and at the post-mortem we find hyperæmia and inflammation of the membranes of the spinal cord. Cranio-tabes is most commonly developed in the second trimestrial period of infant life, and the spasms commonly supervene in the third. If the children survive longer, rickety distortions of the thorax and in the epiphyses of the bones of the trunk often supervene. Half the children succumb.

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[1] Der weiche Hinterkopf. ein Beitrag zur Physiologie und Pathologie der ersten Kindheit; Stuttgart, 1843.

In speaking of spasm of the glottis, we have already adverted to the relation of this disease to eclampsia, (vol. I, p. 335.) The following may severally act as exciting causes: the irritation of dentition, the food of the child, in infants at the breast changes produced in the mother's milk by emotional influences, passions, and other affections, in older children the precocious employment of spirituous beverages, and the abuse of narcotics, though this does not occur as frequently now as formerly; intestinal irritation, whether from over-repletion or helminthiasis, necessarily more frequently after the first two years of life than previously, or swallowing foreign bodies, may also act as exciting causes; of the latter I have lately met with an instance in a child of three years, which, while playing with its brothers and sisters, was suddenly seized with eclampsia, which lasted half an hour: on recovery, a dose of castor oil was administered, and the child passed a marble per anum, which it had before put into its mouth and swallowed. The passage of biliary and renal calculi sometimes operates in a similar manner in adults. The impression produced by intense heat (*coup de soleil*), or cold, sometimes gives rise to the malady, as well as mental emotions, which are often overlooked in children; and I speak not only of fear, anger, alarm, but also of jealousy, envy, and sorrow.[1] Metastatic processes and injuries of the head not unfrequently possess an etiological influence.

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[1] See—Corvisart's translation of Auenbrugger's work: Nouvelle méthode pour connaître les Maladies internes de la Poitrine, Paris, 1808, p. 178; and Brachet; Mémoire sur les Causes des Convulsions chez les Enfants; Paris, 1824, p. 104.

The fatal issue is generally caused by apoplexy, in which case the cerebral tissue is found to be very turgescent and much congested; hydrocephalus is not so frequent a termination. Recovery is secured by the crisis of the brain, sleep, or occasionally by intestinal evacuations.

In selecting our *treatment* the diagnosis is of extreme importance, as many errors have been committed from confounding eclampsia with inflammatory affections of the brain; in our days *inflammation of the brain* is a collective term, like one formerly in vogue, *fits*. I must refer the reader to the detailed description of inflammation of the brain[1] for the minute features, but I may indicate the two main forms which are recognised by marked characters. In the one, there is from the commencement a tumultuous disturbance of the cerebral functions, pain, convulsions, and delirium, complicated with sopor, the latter often becoming so prominent as to cause the disease to resemble apoplexy; in the other, there is a gradual progress and development; some of the cerebral functions suffer first; the first symptoms are pain, convulsion, or paralysis, confined to certain parts; disturbance of the psychical powers supervenes; the complication of symptoms becomes more extended, and more manifold; sopor terminates the series.[2] There are no free intervals as in eclampsia; there is a steady progress in the symptoms, and even when we master the disease, it does not terminate abruptly, nor is there a sudden transition to health.

In order to remove the cause it is imperative upon us, in the first instance, to attend to the part borne by the blood. In children who have previously been healthy, robust, and plethoric, during the period of dentition, or in the course of acute exanthems, it is proper to abstract blood, locally in young children, by venæsection in elder children. But in atrophic children the opposite condition, anæmia, may obtain, after profuse discharges; in this case excitant remedies are advisable.

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[1] [Professor Romberg refers to the third division of the work, which will treat of the Trophoneuroses, and which has not yet appeared.]—Ed.

[2] See Diagnostische und Therapeutische Bemerkungen über Hirnentzündung im kindlichen Alter, in—Wochenschrift für die gesammte Heilkunde, 1844, p. 473.

Nor is it less important to attend to gastric disturbance. When the stomach is suffering from repletion, or the ingestion of noxious substances, an emetic is urgently required; nor should we allow ourselves to be deterred from its employment by the apparent danger of the possibility of cerebral congestion. The derivative effect of alvine evacuations is useful; calomel and castor oil are the most suitable means for this purpose, and may appropriately be combined with enemata of cold water and vinegar. The violence of the spasms, however, by impeding deglutition, often renders it impossible to fulfil the indicatio causalis; a powerful impression is required in order to remove the arrest of the cerebral functions; my own experience teaches me to consider nothing so adapted to secure this object as the affusion of cold water to the head, while the body is in the warm bath; or if the latter cannot be at once procured, the cold water may be poured over the child while it is sitting on its nurse's lap and the head is held over a pan. The affusion must be repeated every hour, or at longer intervals, according to the requirements of the case. When the convulsions have abated, we may apply the remedies above mentioned, but must carefully eschew narcotics, and avoid placing too great reliance on medicines that do not correspond to their reputation: to this class the preparations of zinc more especially belong. After the convulsions have been arrested it is well to continue the use of purgatives for some time. When eclampsia offers an intermitting type, the employment of quinine is indicated. When the disease occurs in infants at the breast, we must subject the mother and the nurse to a strict bodily and mental regimen. When we are called to treat children labouring under cranio-tabes, Elsässer[1] especially recommends attention to be paid to giving the soft and compressible occiput a suitable support in the shape of a horse-hair cushion, with a pyriform opening; into this the occiput is received, so as not to be in contact with anything. The preparations of steel and tan baths (made by adding two or three handfuls of ground oak bark to each bath) are strongly recommended.

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[1] Loc. cit., p. 205.

CHAPTER XXXII.

SPASMS FROM EXCITEMENT OF THE BRAIN.

EPILEPSY.

In order to give a complete delineation of epilepsy, it is quite as important to render the characters which mark the interval as those which belong to the paroxysm.

Description of the Paroxysm.—There frequently are premonitory symptoms of a sensitive, motor, or psychical character; among the former, we class the hyperæsthesiæ of the nerves of the senses, which we so often meet with; sight and hearing are more commonly affected than smell. Two of my patients imagined that they saw human beings and animals, sparks, and luminous flames, immediately preceding the epileptic attacks. Gregory[1] has observed a patient who, before the attack, imagined he saw a little old woman with a red cloak, who ran up to him, and gave him a blow on the head, upon which he fell down. Vertigo accompanied by painful and abnormal sensations in the head, and at distant parts, is a frequent precursor. These sensations are generally comprised in the term aura epileptica, and the patient describes them as resembling a cool or warm puff, or draught, which mounts from the extremities to the thorax and neck, and on reaching the head passes into the paroxysm. The aura, however, but rarely corresponds to its name, as has been already pointed out by Prichard,[2] a most careful observer of epilepsy. I have found the symptoms to occur in about one half of my epileptic patients; in some it assumes the form of formication in the tips of the fingers or toes, affecting one, or less frequently, both sides; in others, it appeared as a creeping sensation in the circumference of the mouth; in a few, as a sudden sensation of heat diffused over the entire body. I have also met with it in the shape of a painful, lacerating, dragging sensation, mounting upwards from the lower extremities, or as hemicrania or mastodynia. The motor aura is not unusual; it occurs as twitching or contraction of the fingers or toes, or of one hand, one foot, one leg; or as spasm of the sterno-cleido-mastoid, drawing the head down on one side. In some patients I have seen twitchings of the muscles of the alæ nasi and the upper lip, which are supplied by the facial nerve; in one, there was the extremely rare phenomenon of spasm of the auricular muscles. (Vide vol. I, p. 292.) Occasionally a sudden relaxation and loss of motility precede. Attacks of a static character are also met with, such as turning round in a circle, walking backwards, (Fried. Hoffmann,) or running forwards.[1] The premonitory symptoms may be of a psychical character, and present themselves as ill temper, melancholy, sleepiness, incapability for mental exertion, absence of mind, and occasionally, though very rarely, as extreme euphoria, (bien être.)[2] I have met with one young man who had been subject to epilepsy for nine years, and who previous to the attack was, as he expressed himself, suddenly seized with a very peculiar train of thought, which was not quite intelligible to him, but caused him intense anxiety. The thoughts were always of the same character, and while he was making the effort to disembarass himself of them, the paroxysm supervened. Little attention has hitherto been paid to the precursory symptoms occurring in the sphere of nutrition. I am informed by Dr. Schönbein that in several patients who were blistered, he observed that immediately before the fit the serum assumed an acrid character, as in Humboldt's galvanic experiment.

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[1] Watson; Lectures, &c., vol. i, p. 612.

[2] See his admirable Treatise on Diseases of the Nervous System; London, 1822, p. 88.

The paroxysm often breaks out abruptly without any warning. The patient, if he happens to be standing, falls on his occiput or side, or, though less frequently, on his face, uttering a piercing cry that alarms both mankind and animals. The convulsions that supervene are more often general, than confined to one side or to a small spot. The head is alternately thrown sideways, or forwards and backwards; the histrionic and masticatory muscles act violently; the forehead is drawn up and down; the eyebrows are corrugated and again relaxed; the eyelids blink and are half closed, so that, as the pupil is turned up, only the white of the eye is visible; the pupil is insusceptible to the stimulus of light, and generally contracted; the mouth is distorted; the teeth grind, or chatter; the extremities suddenly bend, are stretched or are rotated inwards or outwards; the fingers, and especially the thumbs, are bent across the hollow of the hand, and the toes are flexed. At times the spasms are of a tetanic character; when the attack supervenes, the trunk suddenly becomes stiff and inflexible, the head is drawn rigidly to one side or backwards; the arms and legs are stiff and distended, the eye wide open and staring, the jaws compressed, and the tongue jammed in between the teeth and bitten. The fit often commences with a stiffness of the muscles, and then in a brief space of time passes into convulsive movements. The movements of respiration are accelerated, short, irregular, and more or less impeded; if inspiration is in any way arrested, the expiratory muscles act violently. The patient screams and groans. Occasionally the muscles which are under a sympathetic influence are involved, and excrements, urine, and semen are ejaculated during the paroxysms. The heart beats rapidly and irregularly. There is always cerebral insensibility to sensual or tactile stimuli, whilst reflex sensibility continues. I have convinced myself of this fact by introducing a feather or my finger under the eyelids of an epileptic patient, during the paroxysms, and finding that they instantly and forcibly contracted. It is well known that the surface is insensible to punctured and cauterised wounds; but I have repeatedly observed, that sprinkling the face with cold water during the paroxysm produces the same starting of the body as it does in a healthy individual. We have yet to inquire into the manifestations of reflex action resulting from irritation of the mucous membrane; as to whether, for instance, sneezing is produced by the introduction of acrid vapours into the nose, or cough by irritant fumes. Consciousness is entirely in abeyance from the commencement of the paroxysm to its termination. In the vegetative sphere we also meet with phenomena which result from the extreme exertion, the pressure upon venous trunks produced by the powerful contraction of the muscles or the impeded respiration: there is profuse perspiration, foam at the mouth, (frequently tinged with blood owing to the tongue being bitten,) dark livid discoloration of the face, extravasation from minute bloodvessels, ecchymoses resembling those of purpura, in the vicinity of the root of the nose and of the eyelids, and hæmorrhage from the nose and the bronchial mucous membrane.[1] In some patients, the close of the paroxysm is indicated by as definite phenomena as its commencement; and there is vomiting, borborygmi, and eructation; in others the attack is interrupted abruptly, the muscles suddenly relaxing; in another class, again, there is a gradual remission, the muscles of the face twitch with less and less violence, and a profound sigh closes the scene of disturbance and violence. A new series of phenomena ensues; profound stertorous sleep, during which the insensibility continues to a certain degree, overwhelms the patient; the pulse rises, becomes full, soft, and slow; the breathing becomes calm, and the skin perspires. The patient awakes from his sleep, still slightly stupefied, weak, and out of temper, and oblivious of the paroxysm, but gradually recovers his normal state. Many patients require no sleep to pass from the fit to the healthy interval, but at once resume their ordinary occupations.

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[1] Jos. Wenzel; Beobachtungen über den Hirnanhang fallsüchtiger Personen, p. 50.

[2] [The vernacular English offers no word which expresses the meaning of this term; as it appears to convey a definite sense, and as the author frequently employs it, it is proposed to introduce it into English medical terminology. It is scarcely necessary to add, that it is a Greek word, *εὐφορία*, meaning, the capability of bearing anything well, or a happy frame of mind.]—Ed.

These various features present numerous modifications in point of intensity and mode of combination with other conditions, and this not alone in different individuals, but even in the same subject. The most marked difference is found to prevail between the well-developed and the undeveloped paroxysms. The latter either occur at the commencement of the disease only, and subsequently become developed, or they occur between the more perfect paroxysms. There is brief, often but momentary arrest of consciousness, and trivial spasmodic agitation or rigidity of individual groups of muscles: in some, the motor apparatus may not be at all implicated. (Esquirol's Vertigo Epileptica.[2]) We must reckon among these abortive fits those cases in which nothing but the aura occurs. The paroxysms vary in intensity. The succession of the phenomena is also modified by a complication with a psychical affection. A maniacal condition may become associated with the paroxysm, generally accompanied by excitement and violence, and lasting from a few hours to several days.

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[1] Laennec; Traité de l'Auscultation Médiate, 4th ed., par Andral, vol. i, p. 309.

[2] Esquirol; des Maladies Mentales; Paris, 1838, vol. i, p. 277.

The relation existing between epilepsy and paralysis, and which is indicated in a few cases that are on record, is a point of some interest. The younger Pinel has communicated the case of a female idiot, aged eighteen, who was affected with paralysis of the left side. The hand was forcibly bent upon the forearm, and could not be stretched; in walking, which was very much impeded, the left leg dragged. She was subject to epileptic fits, occurring at intervals of about five and twenty days, and then lasting almost without intermission for from thirty to forty hours. She was seized on the 24th of December, 1821, with a paroxysm of this description, which terminated fatally on the fourth day, and during which the paralytic limbs of the left side participated in the violent convulsions. In the necropsy the cranial bones were found thickened, and of eburnian texture; the right hemisphere was atrophic, the cerebral fossi very small and compressed, especially at the frontal and occipital region. The cortical layer presented greater thickness than usual. The lateral ventricles were very small and dry. The cerebral tissue of the right hemisphere, especially under the ventricle, exhibited a remarkable hardness, while the left hemisphere was of the normal consistency. At the region of the eighth and ninth dorsal vertebra, a portion of the spinal column was found to present a pulpy consistency, the diseased portion being defined above and below by a reddish hue, which separated it from the healthy tissues. The sciatic nerve of the left leg, which had long been subject to paralytic contraction, proved to be reddish, and more voluminous than the corresponding nerve of the healthy side.[1] Another case is reported in Moulin's work;[2] it is that of a woman 57 years of age, who for seventeen years had been subject to paralysis of the right side, and had lost the power of speech owing to an apoplectic attack. Two years later she was seized with epilepsy, which recurred regularly every week, and only affected the paralytic limbs. The paroxysm was ushered in by violent pains; the patient uttered a loud cry, lost her consciousness, twitched, foamed at the mouth, then fell into a sleep which lasted two hours, after which she recovered. Copious hæmorrhage into the cerebellum was followed by death. A large apoplectic cyst was discovered in the corpus striatum, and the thalamus opticus containing a sanguinolent serum, underneath which the cerebral tissue was hardened to the extent of three lines, and presented a yellowish-red colour.

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[1] Lallemand; Recherches Anatomo-pathologiques sur l'Encéphale et ses Dépendances, vol. iii, p. 288.

[2] Traité de l'Apoplexie, 1819, p. 74.

The duration of an epileptic attack, when measured by the convulsive stage, as it generally is, lasts from five to ten and fifteen minutes, but if we estimate the different stages collectively, it varies much both among different individuals and in the same subject. The incomplete eruptions often last a few seconds only, while hours and days are required for the evolution of a complete fit. The duration and progress of the disease also exert an influence upon this point; at the commencement the outbreaks are generally shorter than later on, and as the disease increases in intensity the paroxysms become prolonged.

Description of the interval.—Epilepsy, like hysteria, is characterised by features peculiar not alone to the fits but also to the intervals, and which are the more distinct the longer the disease has persisted; they serve as evidence that the constitution of the individual has undergone an entire change. These features, which require to be studied more fully to render our knowledge of them tolerably complete, manifest themselves in the nervous system, as well as in other portions of the organism. In the former, they appear either as the residue of individual symptoms of the paroxysm, as the delirium maniacum and ecstaticum, which may continue for weeks, or as trismus, which in one of my patients continued uninterruptedly for from fourteen to twenty-one days after the fit; or they may present themselves as new affections. One of the most frequent of these is aphonia; the patients, after the comatose stage, though perfectly conscious, find themselves deprived of their voice; in spite of the strongest stimuli, they are unable to produce a sound, and remain dumb for several weeks, till a fresh attack restores the voice. Marshall Hall[1] mentions the case of a patient who, every time that he had had a paroxysm, lost the capability of singing a few of his high notes. In a similar manner dysphagia or bronchial asthma, or vesical ischuria may supervene; the latter causes violent pains and resists the introduction of the catheter, lasts several days, and is sometimes not arrested until the supervention of a fresh paroxysm. Considerable tympanitic distension of the abdomen, with violent pains, tenderness to the touch and on pressure, not unfrequently follow the paroxysm, and may even mislead the inexperienced medical man, from the symptoms resembling those of peritonitis. In addition to these passing affections, an enduring reaction of the disease during the intervals is most distinctly shown in the intellectual powers of the individual. It is characteristic to find a loss of memory, and a diminution in the definiteness of the ideas, combined with greater irritability of temper; a point that was first introduced into forensic medicine by Ernst Platner,[1] for the purpose of estimating the criminality of acts committed by enlarged epileptic subjects. Esquirol remarks, that those epileptics also who are not attacked with insanity are very irritable, capricious, paradoxical, and difficult to deal with, and that their character is peculiar. The expression of the features changes and becomes coarse, there is an appearance of precocious senility; even Aretæus[2] observed, that epilepsy is a destroyer of beauty. The features become distorted, the eyebrows form a larger arch than usual, the axes of the eyes are placed irregularly and obliquely; if the patient looks straightforwards, the cornea is directed too high upwards, and is slightly concealed under the upper eyelid, so that a large portion of the white becomes visible, the lips and the cheeks are somewhat distorted. Cazauvieilh[3] states, that old epileptic subjects have an insecure tottering gait, and stiff and slow movements. The sexual feelings are excited, and epileptic subjects incline to every kind of sexual indulgence. The change in the constitution of an epileptic individual shows itself by the relation of the organism to external influences, and to the internal economy, even in a more marked degree than in hysteria. The tolerance of remedies is the subject that first attracts our attention; general and copious abstraction of blood and its frequent repetition, are but badly borne by epileptics; and we see in this a marked difference from apoplectic conditions. On the other hand, there is a great tolerance of nauseating remedies, and especially of metallic salts; doses of from ten grains to a scruple of sulphate of zinc, as prescribed by Bright, Babington, and others, could scarcely be given in other diseases without exciting vomiting. It appears that the susceptibility for epidemic and contagious diseases is diminished in epileptic patients; Esquirol, however, saw that these patients were not exempt from typhus, although their mortality was much less than that of other classes; he states that of fifty who were attacked, but a very small number died,[1] a fact previously observed by Greding.[2] Finally, it is important to attend to the relation borne by diseases occurring in an epileptic constitution; in the majority of instances, they are less dangerous than they are under other circumstances; and this applies not alone to trismus, tympanitis, and ischuria, but even to inflammations, hæmorrhages, &c.

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[1] On the Diseases and Derangements of the Nervous System; Lond., 1841, p. 327.

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[1] Facta violenta Epilepticorum, quamvis maleficiendi et ulciscendi consilio suscepta, amentiæ excusatione non carere, in: Quæstiones Medicæ Forenses, autore Platner; Lipsiæ, 1824, p. 40.—See also Brach; über die Insana malitia Epilepticorum, in Rust's Magaz. für die gesammte Heilkunde, 1838, p. 1; and Friedrich, Systematisches Handbuch für die gerichtliche Psychologie, p. 637.

[2] Edit. Boerhaave, p. 28.

[3] De l'Epilepsie considérée dans ses rapports avec l'aliénation mentale, in Archives Générales, 1825, p. 66.

Epilepsy runs a chronic course; the individual attacks occurring with greater or less frequency, and with more or less regularity of repetition; points that are much influenced by the duration of the disease, the age of the patient, sex, certain vital processes, and accidental causes. At the commencement of the disease, the paroxysms not unfrequently are far apart, six months and even a year intervening, a point that should be well attended to in respect to prognosis and to therapeutics. In youthful subjects and during the period of development, the fits approach nearer to one another. The periodical occurrence of the paroxysms in the female sex often depends upon the sexual processes; there is a monthly type, or the paroxysms become more frequent and more violent at the time of menstruation. A female patient of mine was seized every four weeks; every paroxysm lasted twenty-four hours, so that during this time, twelve fits occurred, which were separated from one another by a stage of coma which lasted nearly two hours. It was remarkable that the patient did not recover herself entirely until the whole paroxysm had passed off; but if the twelve fits failed to take place, the patient continued to complain of a sense of discomfort and anxiety, until the deficient fits had presented themselves. In one young girl, the fits at the commencement of the disease occurred punctually every other day at five o'clock in the evening; quinine had no other effect than that of effacing this regular type. Dr. Henoch who accompanied a young man, subject to epileptic fits, who was a patient of my own, to Heligoland, found that the attacks which had previously occurred at irregular intervals of a longer or shorter duration, assumed a definite type during the use of the sea-baths; they took place uniformly between eight and half-past eight o'clock in the morning, on every seventh day; this type disappeared as soon as the patient had left the watering place. The waking and sleeping states exercise an undoubted influence upon the occurrence of the paroxysm; that this does not depend upon the position of the sun or the difference of the diurnal period, is proved by the fact that epileptic subjects, who have their fits when asleep are also attacked during broad daylight, if they happen to yield to Morpheus.[1] The planetary influence of the moon (especially of the new and full moon,) upon the course of epilepsy, was known to the ancients, and although here and there doubts have been raised against this view, the accurate observations of others have established its correctness; Esquirol is opposed to it, and says that in the Parisian Hospitals no relation has been observed between the frequency of the fits and the phases of the moon. Stahl[2] and Mead[3] are in favour of the doctrine; the latter mentions the case of an epileptic girl aged 5 years, whose attacks came on daily with high water and ceased at low water; and this occurred with such punctuality, that the loud scream with which the patient invariably recovered from her fit, was the signal which awoke the father, a waterman living at the Thames side, and told him that it was time for the commencement of his business. Some authors are inclined to ascribe a similar influence to the equinoxes as to the lunar changes; Clarus[1] has observed, that the greatest frequency of epileptic seizures occurs in spring.

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[1] Dictionnaire des Sciences Médicales, vol. xii, p. 515.

[2] Sämmtliche Medicinische Schriften, vol. i, p. 288.

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[1] Prichard; loc. cit., p. 92.—Esquirol, p. 281.

[2] Theor. Medic., pt. ii, sect. 3, numb. 3, p. 683; and Dissertatio de Hereditaria Predispositione in Varios Morbos; Halæ, 1706, § 76, p. 48.

[3] Opera Medica, edit. Goetting, 1748, p. 28.

When epilepsy lasts a long time, it very frequently becomes complicated with psychical derangement; it rarely does so from the commencement. A statistical analysis made by Esquirol has shown, that of 339 epileptics, 269, or four fifths, were in a state of mental alienation; the most frequent form being dementia, next in order mania, and though rarely, monomania.

In estimating the necropsies of epileptic subjects, authors have not hitherto proceeded with sufficient critical acumen, and have introduced the morbid changes caused by complications or cadaveric alteration as essential to epilepsy. Too little attention has also been paid to the duration of the disease, in judging of the post-mortem appearances, though this is necessarily a point of great consequence. It is only necessary to examine the osseous envelopes of the brain to be convinced of this. The longer the epilepsy has existed, the thicker the cranial bones become, and they assume an almost eburnean density. The prominences of the inner surface project strongly and sharply, so that it is almost painful to pass the hand over it. Greding,[2] whose writings are distinguished by their accuracy and minuteness, mentions that he found sharp projections at the posterior clinoid processes, and either at one or both sides. Osseous deposits in the dura mater, in the falciform process, and other parts, occur frequently in epileptic subjects. The membranous investments present the appearances common to chronic affections of the brain, in the shape of thickening of adhesions, sero-albuminous exudations, and a large number of Pacchionian glands,[3] which are mainly seated on the surface of the cerebrum. The examinations of the brain have not generally afforded any very instructive results; a consequence partly of the incompleteness of the mode of investigation, partly of the complication with other diseases, whose morbid changes have been set down as the effects of epilepsy, *e. g.* hæmorrhages and their residuary products. Ferrus states that hypertrophy of the brain, with an increased density of the medullary tissue, and with hypertrophy of the cranial bones, is very commonly met with in epileptic subjects; Parchappe[1] also speaks of the weight of the brain being considerably increased. The researches of Joseph Wenzel, with regard to the relations of the pituitary body in this disease, promised more positive results; he found that hypertrophy, or atrophy of one or both lobes of the pituitary body, inflammation, exudations of the surface and between the lobes, reddening and swelling of the infundibulum, occurred in combination with morbid changes in the neighbouring bones, such as contraction or dilatation of the sella turcica, obliquity, shortening or thinning of the posterior ascending lamella.[2] These changes are not met with uniformly in cases of epilepsy;[3] and, on the other hand, disorganisation of the pituitary body occurs without epilepsy, as proved by the case of facial neuralgia previously described, (vol. I, p. 43,) and by Engel's[4] excellent monograph on the pituitary body and the infundibulum; yet Wenzel's investigations, which will ever serve as a pattern of accurate research, are of importance, because they have for their object the consideration of the morbid processes of the anterior cranial vertebra; this encloses the pituitary gland, which, according to Antenrieth, Burdach, and Arnold, is to be looked upon as the continuation, and, as it were, the bud of the grey centre of the spinal cord. The experiments made by Sir Astley Cooper on the subject of the arrest of the circulating current in the vertebral and carotid arteries, and the condition of their osseous channels, should be an inducement to renewed research into the existence of similar influences in epilepsy. Esquirol[5] was the first to direct attention to the state of the spinal cord in epileptic subjects.

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[1] Der Krampf, in Pathologischer und Therapeutischer Hinsicht Systematisch erläutert, p. 248.

[2] Sämmtliche Medicinische Schriften; Greitz, 1790, vol. i, pp. 277—350.

[3] Jos. et Carol. Wenzel; De Penitiori Structura Cerebri hominis et brutorum; Tubing, 1812, p. 12.—Greding; loc. cit., p. 290.

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[1] Recherches sur l'Encéphale, sa Structure, ses Fonctions, et ses Maladies; Paris, 1838, 2 Mémoire, p. 204.

[2] Joseph Wenzel's Beobachtungen über den Hirnanhang fallsüchtiger Personen. nach seinem Tode herausgegeben von Carl Wenzel; Mainz, 1810.

[3] Romberg; Ergebnisse einiger Leichenöffungen,—in Horn's Archiv für Medic. Erfahrung, 1823, p. 255.

[4] Engel; über den Hirnanhang und den Trichter; Wien, 1839.

[5] Loc. cit., p. 311.

The cadaveric changes most frequently met with are, cartilaginous laminæ in the spinal arachnoid and partial softening, especially in the lumbar region. It is, however, impossible to determine whether these changes have not existed simply as complications, as we do not possess the histories of the cases; some cases communicated by Ollivier[1] indubitably demonstrate the existence of such a relation.

Causes.—The chief predisposing cause is that due to hereditary influences; Cazauvieilh and Bouchet have made some statistical inquiries into this subject, both in the descending and ascending line, and have found that of 110 epileptic patients, there were 31 who had epileptic parents or relations, or nearly one third. Fourteen epileptic mothers gave birth to 58 children, 37 of whom had died, the eldest at the age of 14, the remainder at a very early age, and almost all in convulsions. Twenty-one survived, of these 14 were healthy; though very young, some were already epileptic. It has sometimes been observed that a generation has been passed over; the near relation existing between epilepsy and insanity is also shown in the hereditary predisposition; we often find that insanity affects the parents or relations of epileptics. The outbreak of hereditary epilepsy generally takes place before puberty. Besides the hereditary predisposition, we also find a congenital taint spoken of; but it is a very rare occurrence to find new born infants subject to epileptic attacks, they generally supervene at a later period, after the first dentition, or after weaning, and they may then also be due to an hereditary taint. The instances of mothers who, after a fright, or from seeing an epileptic patient, gave birth to children labouring under this complaint, without themselves having been affected, are not sufficiently authenticated. The predisposition afforded by a certain age is of much more consequence; the proclivity to the disease during the first four quinquennial periods of life is three times greater than it is subsequently. Cazauvieilh has compared sixty-six cases in reference to this point. They were distributed as follows:—

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[1] Traité des Maladies de la Moëlle Epinière, 3d ed.: Paris, 1837, vol. ii, p. 570.

From birth to the 5th year	18	Total, 50.
the 5th „ 10th „	11	
„ 10th „ 15th „	11	
„ 15th „ 20th „	10	
„ 20th „ 25th „	5	Total, 16.
„ 25th „ 30th „	4	
„ 30th „ 35th „	1	
„ 35th „ 40th „	2	
„ 40th „ 45th „	1	
„ 45th „ 50th „	2	
„ 50th „ 55th „	0	
„ 55th „ 60th „	1	

I have attended an old lady of 56 years of age, who in her fifty-fifth year, after the cessation of her menstrual period, was seized with epilepsy, the paroxysms of which only occurred at night-time. Instances of the occurrence of epilepsy at a later period of life are very rare: Maisonneuve, in his valuable work, 'Recherches et Observations sur l'Epilepsie,' has communicated two cases, one of which occurred in a man of seventy-two years, who was first attacked in his sixty-ninth, the other in a female of seventy-five, who was first seized in her sixty-second year. According to Tissot and Esquirol, the difference of liability, owing to sex, is not manifested until the seventh year, after which the female sex appears to be more prone to the disease than the male sex. The influence due to climate and ethnical relations has not as yet been determined.

The question of the connection existing between the etiology and the diagnosis of the complaint, is one of too great importance not to attract our consideration also. When epilepsy occurs at the earlier periods of life, and before puberty, it is generally followed by idiocy, and is frequently complicated with paralysis of single members. The attacks, as Maisonneuve, an accurate observer of Pinel's school, states, are always incomplete at the commencement, afterwards generally occur without any premonitory symptoms, and only last a short time. The convulsions are neither violent nor general, and they mainly affect the face and upper extremities. The intervals are often of considerable duration, and occasionally the disease ceases during childhood to return in manhood.

The causes inducing epilepsy that reside in the nervous system may occupy the peripheral or central tracts. But few cases are on record of the morbid excitant being seated in the cerebro-spinal, and none to my knowledge of its being found in the sympathetic system. One of the oldest observations is given by Short (1720); in this, there was a neuroma of the size of a pea in the vicinity of the muscles of the calves; De Haen[1] communicates another, in which two neuromatous tumours occupied the phrenic nerve, and in which there was atrophy of the thalami optici. Two others are quoted by Henning[2] of neuroma of the vagus and of the crural nerve. Instances of local affections, especially about the extremities, which to judge by the symptoms appeared to reside in the nerves themselves, have been described by Portal,[3] Maisonneuve,[4] Larrey,[5] and others. In one quoted by the second of the authors mentioned, there was traction caused by two cicatrices on the foot resulting from a venesection; in a case mentioned by Larrey, there was injury to the internal cutaneous nerve, caused by an operation at the elbow-joint. The following occurred under my own observation. A labouring man of robust constitution, who applied for relief in the Policlinique, had fallen three years previously upon his right knee, in consequence of which the joint had become disorganised. The patient had from this period suffered from epileptic attacks. The aura epileptica commenced as a creeping sensation in the large toe of the right foot. From here it mounted upwards along the inner surface of the leg and thigh, and ended in the epileptic seizure. In this case the aura did not proceed from the seat of injury, the knee-joint; but when we consider that the sensibility of the integuments at the inner side of the knee-joint, as well as those of the large toe, is derived from the same nerve, the saphenus major, the connection between the aura and the cause of disease seems undeniable. Among the symptoms which characterise that form of epilepsy which originates in a peripheral affection of the nerves, the aura, which is both of a sensory and a motor character, deserves the first mention. At the commencement of the disease it exists by itself, and is only occasionally associated with vertigo and confusion of intellect as it passes upwards. After a time the complete paroxysms are developed, during the intervals of which, however, abortive fits are yet often perceptible. The patient at the same time often complains of a painful sensation, or of spasm at a definite point, which is increased by external contact and pressure. Occasionally a small tumour, or some discoloration may be discovered. The attacks themselves may frequently be intercepted by isolating the point from which the aura takes its origin.

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[1] Ratio Medendi, p. 127.

[2] Analecta Literaria Epilepsiam Spectantia; Lipsiæ, 1795, p. 38.

[3] Cours d'Anatomie Médicale, vol. iv, p. 247.

[4] Loc. cit., p. 207.

[5] Clinique Chirurgicale, vol. i, p. 490.

Strong impressions made upon the nerves of the senses, and especially upon the optic nerve, have occasionally given rise to epileptic seizures. Maisonneuve relates two striking instances of this. One occurred in a girl of 5 years, who amused herself one summer's day by looking at the sun for several minutes, and was thereupon attacked with epilepsy, to which she remained subject for nine years afterwards: the second patient, when 9 years of age, had stared at the sun for several minutes, and was much alarmed at seeing what she took for a large black head; in the evening of the same day she related the circumstance to her mother, and was at once seized with epileptic convulsions, which afterwards returned at tolerably regular intervals. Tissot[1] mentions a young man who was seized with epilepsy whenever he saw a red object.

The causes of epilepsy that reside in the brain are not unfrequently injuries and their consequences, as well as diseases of the cranial bones from constitutional affections, such as syphilis, &c., instances of which may be found in the annals of surgery. This variety of epilepsy occurs more frequently in the male than in the female sex, and increases with age; if diseases of the bones are the origin of the complaint, the fits are easily induced by external pressure upon the skull. In the intervals the patient complains of abnormal and painful sensations in the head, and does not enjoy the same health that we find in other epileptic subjects. In the course of the disease apoplectic conditions and paralyses supervene. The eccentric aura is a point of physiological interest; it affects the side opposite to the one in which the disease of the cerebral hemisphere resides, and is generally confined to the upper extremity. Odier[1] mentions the case of a soldier, who, after having received a sabre-cut across the left side of his head, often suffered from spasmodic contractions of the little finger of the right hand, which subsequently extended to the forearm, shoulder, and neck, and each time ended in an epileptic seizure. After having tried numerous remedies without any result, Odier advised him to bind a cord tightly round the arm at two places, between the elbow and wrist and between the shoulder and elbow; by following this suggestion, the epileptic paroxysms were staved off for three years. On one occasion the patient forgot it during a fit of intoxication, and he died during the attack that followed. At the post-mortem examination, a trace of the sabre-cut was found in the left parietal bone, with a projection of the internal osseous lamella of a carious character. Underneath the dura mater a sanguineous tumour of soft consistency and about the size of an apple was discovered at this point, containing a quantity of clear watery fluid.

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[1] Abhandlungen über die Nerven und deren Krankheiten, deutsch herausgegeben von Ackermann, vol. iii, p. 283.

Mental influences are far more frequent causes of epilepsy than injuries; among forty-four cases, the causes of which were carefully examined by Cazauvieilh, we find that in thirty-one their origin was attributable to an influence of this character. No disease is so liable to be produced by fright as this affection, which may itself be excited by the sight of an epileptic paroxysm; the next most frequent influence of this description is fear, an agent that came into operation more often in former times, when tales of ghosts and hobgoblins were the bane of the nursery, than at present; anger also comes under this category as an exciting cause. The female sex is chiefly predisposed, and is the more liable to be affected if the mental excitement operates during the catamenial period; there are also numerous instances on record, of attempts to commit rape inducing the sudden outbreak of epilepsy. The middle period of life generally remains exempt. Mental emotions that have induced the first attack are very apt to reproduce it subsequently, and if delirium supervenes, it generally turns upon the first cause of alarm. Thus Maisonneuve[2] mentions a woman who, thirty-six years after the first fit, fancied, during the maniacal stage, that she saw the man who at that time had, during her menstrual period, struck her on the back with a spade. The simulation of epilepsy also operates as a mental influence, and is said occasionally to pass into the real disease.

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[1] Médecine Pratique, p. 181.

[2] Loc. cit., p. 51.

Next in order to the nervous system, we have to consider the blood and the vascular system in their etiological relations to epilepsy. The time has scarcely elapsed at which congestion of the brain was looked upon as the almost exclusive cause of nervous diseases, and also of epilepsy. In the present state of science, an assertion of this kind to be tenable requires to be supported by well-founded arguments; it is surprising, therefore, that hypertrophy of the left ventricle, a morbid condition which of all others gives rise to an increased flow of blood to the brain and induces hæmorrhage, scarcely ever causes epileptic seizures, though it is frequently associated with vertigo, apoplexy, and paralysis. There can be no doubt that plethora arising from the suppression of accustomed sanguineous discharges, especially catamenia, epistaxis, and though less frequently hæmorrhoids, or from an injurious mode of life, may exert a predisposing influence. The variety of epilepsy arising in this way presents an apoplectic admixture; there are weak convulsions, followed by a soporous state, which may last for hours and even for days, as well as by incomplete paralysis of individual parts, especially of the tongue. The opposite condition, anæmia, is more frequently the source of the disease, and especially in the female sex, whether resulting from an original bloodcrasis, or from insufficient nourishment and from profuse discharges. Maisonneuve[1] relates the case of eighteen sailors, who having saved themselves on a rock by swimming away from the enemy, were for seven days exposed to great deprivation and severe cold; four weeks after they had been received into an hospital they were seized with epileptic attacks, before and after which they suffered very violent pains in the right hypochondrium. Ten months after, six had died, eighteen months later eight more, and only four survived.

Among the profluvia, those associated with over-excitement are the most fertile sources of epilepsy, such as self-abuse and sexual excesses; there are individuals, especially of the male sex, who are seized with epilepsy after every act of coition.

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[1] Loc. cit., p. 229.

The uterine system, often under the influence of an anæmic state of the constitution, occupies an important position in the etiology of the disease. Menstruation is undeveloped, irregular, suppressed, or too frequent, but rarely profuse; the mammæ swell and become indurated periodically, and there is fluor albus; there are permanent or occasional pains in the hypogastric region; hysterical paroxysms precede for a long time, and afterwards alternate with the epileptic paroxysms; the latter themselves present some hysterical features; we find the globus hystericus occurring as an aura, or there are respiratory spasms, imminent suffocation, singultus, tympanitis or hæmatemesis, and the fits preserve a connection with the menstrual type; the spasmodic attacks follow the paroxysms more frequently than in other varieties of the disorder. It is here that the ecstatic condition especially manifests itself, and when insanity occurs it assumes the character of nymphomania.[1] It is reserved for future investigations to show that there is a connection between the local affections of the uterus and epilepsy, such as exists in hysteria.

The next focus of epileptic affections that we have to consider is the gastro-intestinal tract. Irritation proceeding from the intestinal canal and of its glandular apparatus, the former more frequently in children, the latter in adults, acts as a cause of epilepsy; it may be induced by helminthiasis, and especially by lumbricus, less frequently by tænia and ascarides, by catarrh of the stomach and intestines, and by inflammatory affections of the liver.[2] The paroxysms are not unfrequently ushered in by symptoms proceeding from the abdominal nerves; such as pain, tension, and a sensation of cold in the umbilical region, or in the hypochondria, a sense of heat rising upwards from the scrobiculus cordis, nausea, vomiturition, and occasionally dragging pains in the shoulder and the corresponding arm. During the intervals we find indications of intestinal and hepatic disturbance; constipation alternates with diarrhœa, the evacuations are of an abnormal character, there is anorexia and bulimia, icterus appears and disappears with the paroxysms, the abdomen is tympanitic, and presents more or less palpable alterations, there is an abdominal complexion, and the tongue is coated. Little attention has been paid to the etiological relation existing between the kidneys and epilepsy until the most recent period, although the observations of the occurrence of epilepsy after the suppression of dropsical conditions point to this fact, and the influence of the blood dyscrasia in Bright's disease cannot be overlooked. Of all the organic apparatuses, those of circulation and respiration exert the smallest influence in the production of epileptic affections.

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[1] Consult on this subject—Sinogowitz; über Krampfformen eigenthümlicher Art und deren Verhältniss zu Sexualstörungen bei weiblichen Individuen, in Rust's Magazin für die gesammte Heilkunde, vol. xxiii, p. 195.

[2] Prichard; loc. cit., pp. 251 and 323.

Metastatic processes have been more frequently assumed as causes of epilepsy than proved to be such, as used to be the case when the metastasis of scabies was a favorite subject. There are some indubitable cases on record, however, in which the disease has made its appearance after the removal of long-standing tumours of the surface, after chronic ulcers, whether natural or artificial, have been dried up, and after the disappearance of impetiginous or arthritic affections.

Finally we are forced to the unpleasant confession, that notwithstanding the conscientious investigations of this powerful disease, its causes frequently remain an entire mystery.

Diagnosis and Nosology.—Excepting insanity, there is no disease which is so frequently simulated by recruits, beggars, and vagabonds, as epilepsy, and they often succeed in producing a most perfect counterfeit. In order to discover the deception, medical men have hitherto remained satisfied with deriving the criteria from the paroxysm itself. I am acquainted with none that is so trustworthy as the insusceptibility of the pupil when the sun- or candle-light is thrown upon it, which cannot be imitated by any one. Anæsthesia generally suffices to recognise the cheat, but instances are known of impostors having allowed themselves to be burnt with the actual cautery without evincing any sense of pain: a murderess, who simulated epileptic attacks with the utmost truth, showed Van Swieten and De Haen[1] three cicatrices of burns made on her hand in this way. At the same time we must be careful not to confound the reflex sensibility, which continues even during the paroxysm, with the cessation of cerebral sensibility, and we must guard against mistaking the impression produced by sprinkling water, or by applying a feather to the eyelid, for an act of consciousness. The epileptic subject does not select the place where he will fall, on the supervention of the paroxysm, unless an aura gives him warning; the impostor, on the other hand, takes the proper precautions: it is well known how a cheat of this kind was once discovered in Paris, by setting fire to the straw upon which the impostor fell, which caused him at once to take to his heels. If during an epileptic fit we forcibly unbend the thumbs, which are drawn across the palm of the hand, they remain so till the end of the attack, or close again on the supervention of a fresh convulsion. In case of a pseudo-epileptic seizure, the thumbs are more easily opened, and the subject immediately closes them again, because he considers it an essential feature of the disease.[1] Even the aura is not absent in simulated epilepsy, but the impostor shows his ignorance by indicating an impossible current. Sauvages[2] relates the following instructive case in point: "Puella septennis, epilepsiam simulabat tam apposite, ut nemo in nosocomio generali dolum suspicaretur. Interrogata num sentiret auram ex manu ad humerum, inde ad dorsum et femur, ea annuit; præscripsi usum verberum, quo audito sanata est." The criteria deducible from the period of intermission are not less important; epileptic subjects have a dislike to talk of their disease, they feel ashamed of it, while impostors are in the habit of making a boast of it. There is no simulation of the loss of mental energy or the loss of memory, and the experienced physician will not fail to miss the features in the general habit of the patient, which we have above alluded to.

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[1] De Haën; Ratio Medendi, p. 135.

It is not sufficient to be on our guard with reference to simulated epilepsy, we must also be aware of the possibility of the disease not becoming patent, of its remaining unknown to the patient himself, or of its being concealed. Nocturnal attacks are apt to remain unobserved; and they may, if of frequent occurrence, induce weakness of memory and loss of the intellectual powers, and occasionally a transitory state of insanity. Small ecchymoses in the eyelids, the cheeks, and at the root of the nose; bites of the tongue, blood-spots on the pillow, lead us to suspect the nature of the case, and our suspicions are confirmed by watching the patient.

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[1] Marc; in the art. Epilepsie simulée, in Dictionnaire des Sciences Médicales, vol. xii, p. 542.

[2] Nosolog. Method., ed. Daniel, vol. iii, p. 116.

We have already (vol. II, p. 89), alluded to the features by which we distinguish between hysterical convulsions and epileptic seizures.

In a nosological point of view, the division of the subject into idiopathic and sympathetic epilepsy, which has been handed down to us from ancient times, is extremely valuable; we may substitute for this the more correct physiological terminology of a central and centripetal variety. All other divisions only refer to complications or accidental circumstances, and more or less we may apply to them the denunciations which the ancient Greek, in one of the most magnificent productions of medical literature, *Περὶ Νόσου ἁγίου*, has fulminated against those who classified epilepsy theologically according to the screams of the patient, and other accidental trivialities:[1] "For if they imitate a goat, or grind their teeth, or if their right side be convulsed, they say that the mother of the gods is the cause; but if they speak in a sharp or more intense tone, they resemble this state to a horse, and say that Neptune is the cause. Or if any excrement be passed, which is often the case, owing to the violence of the disease, the appellation of Enodias Hecate is adhibited; or if it be passed in smaller and denser masses, like bird's, it is said to be from Apollo Nomius. But if foam be emitted from the mouth and the patient kick with his feet, Mars gets the blame. But terrors which happen during the night, and fevers and delirium, and jumpings out of bed and frightful apparitions, and fleeing away, all these they hold to be the plots of Hecate, and the invasions of the nerves, and use purifications and incantations, and, as appears, make the divinity appear most wicked and most impious."

Our prognosis must, in the first instance, depend upon the duration of epilepsy; every year the resistance to recovery increases; for this reason, that form which has existed from the first year of life is incurable; it is this also which most frequently induces idiocy, and shortens the duration of life. The age of the patient is less material, in point of prognosis, although that form of epilepsy is less favorable which appears in the middle period of life than that which occurs about puberty and in infancy. Among the causes, hereditary predisposition, alarm, and cerebral injury are the most serious. Eccentric causes afford a better prospect, especially when residing in the uterus, the stomach, or in peripheral nerves. When associated with insanity and idiocy, no treatment avails anything.

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[1] The genuine Works of Hippocrates, translated by Dr. Adams; Sydenham Society's edition, vol. ii, p. 846.

The fatal issue is less frequently brought about in the attack itself than by the agency of other diseases. In the former case, it is generally owing to asphyxia, or the rupture of a vessel, especially in the brain, sometimes also in the lungs and in aneurisms. Of other morbid conditions, we find tubercular phthisis, whether of the lungs or the intestines, the most frequent causes of death in epileptic subjects. Of sixty-two epileptic subjects whose cases have been analysed by Greding,[1] more than half died in this way; nineteen died of pulmonary, and fifteen of intestinal consumption.

Recovery may take place spontaneously, or by the aid of medical interference. A spontaneous cure has been observed to follow the eruption of ulcers, or skin diseases, hæmorrhages, menstruation, intermittent fever, dysentery, arthritis; and what appears peculiarly interesting, the occurrence of amaurosis.[2] It is less usual to find a vicarious relation to other diseases in epilepsy than in mania. We sometimes find the disease arrested during the course of acute complaints, and very often during pregnancy, but we also meet with cases of an opposite character. We had a woman in the clinical wards, who, during five successive pregnancies, laboured under epilepsy, but never in the unimpregnated state. In two other females epilepsy occurred during lactation; it occurred in one during the following lactation, whilst she had been free from it during the interval. Epileptic subjects are rarely attacked with puerperal convulsions. It only occurred twice in fifty-one deliveries of epileptic women.[3] Occasionally the intervals in epilepsy are much protracted, the physician should therefore exercise much caution in prognosticating a permanent recovery.

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[1] Loc. cit., p. 285.

[2] Esquirol; loc. cit., p. 282.

[3] Tyler Smith; in Lancet, 1849, No. xxiv, p. 644.

A healthy boy became epileptic in his tenth year in consequence of fright, and the fits occurred regularly at the same hour in the evening; after a time they ceased without medical advice, so that the parents ventured to hope that a permanent recovery had taken place. Two years later he was seized with violent pain in the forehead, accompanied with nausea and occasionally with vomiting. While suffering in this way he went skating, and fell on his head; the very same day the epileptic fits returned, and appeared regularly every evening between ten and eleven o'clock, when the boy was going to sleep. In another case which fell under my observation the interval was still longer, but here there was an undoubted hereditary predisposition. The patient had been subject to epilepsy from his sixth to his thirteenth year. The fits gradually disappeared, the individual was able to serve his time in the army, and continued in perfect health until his thirty-third year. About this time, after having remained in abeyance for twenty years, the disease again broke out after a violent vexation, and in this instance it was much more intense than it had ever been before.

In our *treatment* we have to direct our attention to the paroxysm and to the general morbid condition. In the former we have to protect the patient from injury; the floor of his room should be covered with a thick carpet; the bed should be low, to render the falling out during the nocturnal paroxysms less dangerous. It is not always sufficient to introduce a wooden wedge between the teeth to prevent the tongue from being bitten; all tight ligatures encircling the body should be loosened; the fit itself, when it has commenced, should be allowed to take its course; we must give up the idea of interrupting it, for the more complete the paroxysm, especially after a long interval, the more perfect is the euphoria of the patient. If we blame the non-medical friend, who considers the closed thumbs to constitute the essential character of the disease, and therefore thinks to give relief by forcing them open, we must be equally careful to avoid unnecessary interference; under this head we would also class the manipulations of animal magnetism. We must disturb the sleep that follows the fit as little as the convulsions themselves; yet we should be able to recognise the apoplectic sopor, which, though it rarely does so, may supervene.

The radical treatment must, in the first instance, depend upon the indication afforded by the cause. We can achieve least when there is an hereditary predisposition; all we can do is to attend to whatever will aid in preventing the fit. It appears from the quotation of a passage in Paris and Fonblanque's medical jurisprudence by Joseph Frank, that among the ancient Scotch it was customary to perform castration upon epileptic and maniacal subjects, in order to prevent the disease from being conveyed to a new generation. In families in which epilepsy is a pathological heirloom, the intermarriage of the members should be prevented, and the principle of veterinary surgery, of crossing the breeds with good blood, should be followed. The children born of parents with an epileptic taint should be tended with peculiar care. If the mother is liable to the disease, she ought not to nurse her infant, but it should be intrusted to a healthy wet-nurse. During youth intellectual exertion should be avoided; by following out such precautions, epileptic subjects have been trained to become the rulers of nations.

Causes of epilepsy residing in peripheral nerve-tracts have been occasionally removed with permanent success by an operative proceeding; neuromatous growths may be excised, as recommended by Carron, Short, and Maisonneuve; adhesions of nervous filaments and dragging cicatrices may be treated by cauterisation. It has been advised in this case to maintain suppuration in the part for a considerable time. Dieffenbach[1] has communicated the case of a young girl, who some years previously had cut her hand by falling upon a broken bottle. Violent neuralgic pains; epileptic seizures; contraction with complete emaciation and entire uselessness of the limb resulted. The fingers had partly become contracted from spasms and partly by hard cicatrices. On excising the cicatrices a small splinter of glass resembling a fine fish scale was discovered; it had divided a nerve, which at this point was indurated, and enlarged. After the operation the neuralgia, the epilepsy, the contraction, and emaciation of the limb disappeared; the patient recovered entirely, and regained the full use of her limb. We may also briefly quote an observation by

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[1] Die Operative Chirurgie, vol. i, p. 852.

Joseph Frank.[1] A young man, aged 23, who had always enjoyed good health, received a cut of a whip across his scrotum while asleep. The inflammation of the scrotum and the retention of urine that followed were removed, but repeated seminal discharges, which previously had been very rare, took place every night. For this affection cold baths were ordered. In the sixth bath the patient was seized with violent convulsions, which returned daily. After this the discharges ceased. Eight months later the young man was admitted into the clinical ward of Dr. Frank. Paroxysms that varied in duration returned almost weekly; after each fit the testicles were drawn up; the left epididymis was excessively tender. Dr. Frank advised castration, which was performed, and though the testicles presented no morbid appearances the epileptic fits did not return, and eleven years later the patient was still found to continue free from epileptic seizures.

Under these circumstances we may be allowed to expect some success from interrupting the precursory aura by ligature, compression, friction, extension of the limbs, &c. It is necessary always to direct our attention to the cranial bones, and examine them as to the existence of any lesion, whether the result of dyscrasia or injury; it is absolutely necessary to make a careful exploration of the head, which is only too often neglected. These cases are the triumphs of surgery. Travers[2] relates the case of an epileptic boy in St. Thomas's Hospital in London, whose cranium presented a depression, which was tender on pressure. The trephine was applied, and the concave portion removed; on raising it a violent epileptic fit occurred, but it was the last. From the inner lamella an osseous spicula projected about an inch in length, which compressed the dura mater. Good results have also been obtained by crucial incisions into the integuments, and by keeping a large fontanelle open for a length of time. In syphilitic nodes Larrey strongly recommends the combination of the local treatment by blisters with a mercurial course.

We will only make a few remarks on the treatment of those forms of epilepsy which are caused by morbid conditions of other organs, in order to avoid the repetition of well-known facts. Severe antiphlogistic treatment rarely answers the purpose, and even in recent cases that are based upon a plethoric constitution the abstraction of large quantities of blood is not successful. Independently of the enduring effects of a suitable dietary we must advert to a proceeding which directly deprives the brain, whether both hemispheres or only one, of a large portion of its nutrient material, and also alters the important influence of the intra-vascular pressure. We allude to the compression of one or both carotids, upon the action of which in various nervous diseases, one of the most trustworthy and accurate observers, C. H. Parry, made observations as long as sixty years ago. In the following instance the influence of this proceeding was very marked.[1]

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[1] Praxeos Medicæ Universæ Præcepta, vol. i, p. 476.

[2] A further Inquiry, &c., p. 285.

A widow of 51 years, after having sat in a very cold room one day in February, was seized with paralysis and rigidity of the left side. This soon left her, but the left ear became excessively sensitive to noises of every kind, and creeping and pricking sensations commenced in the fingers of the left hand. Motility continued undisturbed. In six weeks the rigidity extended to the right side. Blisters were applied to the back and the inner side of the left arm above the elbow; the latter only induced inflammation, without raising a blister. After this the patient felt the muscles of her upper arm contracted and stiff. This sensation extended over the head and nape, and then over the entire body, so that she could not be well on either side. She now suffered occasionally from flushing of the head and face, with a waving noise in the occiput. The sense of tension continued, and sensibility remained exalted. The contact of the cold air to the skin was unpleasant to the patient, the finest flannel appeared rough, and the prick of a pin was extremely painful. Soon after, vibrations in certain groups of the flexors of the forearm and in the deltoid of the left side were noticed, and continued as long as the limb retained the usual position, and the forearm and hand lay on the lap. If the arm was forcibly drawn down, the oscillations of the flexors ceased, but continued in the deltoid; they also disappeared when the arm was extended forwards, but at once returned when the muscles were relaxed. The vibrations varied in frequency, but were tolerably regular, generally 80 in the minute, like the pulse. Every time that the patient became heated and fatigued they increased in frequency and intensity. The beat of the carotids was full and strong, and these arteries were themselves unusually dilated. The patient complained of a tension and pain in the head, and cold in the feet. The bowels were sluggish, and the urine more or less pale. Parry predicts that pressure upon the right carotid would remove this attack, but that it would not be influenced by compressing the left; and this proved to be the case every time that pressure was applied. These experiments were subsequently repeated in London by Dr. Baillie, with the same result. In 1786 Parry had a patient under his care who suffered from repeated attacks of violent headache, delirium, and convulsions, the latter were so violent that it required three men to hold her. On applying pressure to one or both carotids all convulsive symptoms at once ceased. Mere pressure upon the skin was not the cause of this effect, for if any other part of the skin was touched but the carotids no result followed. Parry assures us that he has succeeded, in the course of twenty years, in curing a number of cerebral affections, which had resisted other modes of treatment, by this compression of the carotids; he recommends it to be performed by pressing the thumb on a level with the superior border of the cricoid cartilage against the vertebræ. The same writer communicates some instructive remarks on the pulse in the carotids in nervous diseases, and on their dilatation as a predisposing element, which are the more deserving of our attention, as they come from a person[1] who is so thoroughly acquainted with the arterial pulse.

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[1] Collections from the unpublished writings of the late Caleb Hillier Parry, vol. i; London, 1825, p. 318.

I have repeated the experiment of compressing the carotids, and have found the proceeding to be an effectual prophylactic if employed in patients who have forewarnings of their attacks, and are able to apply it in time. An architect, 28 years of age, by this means was enabled to prevent the epileptic paroxysm whenever he was seized with vertigo, and when he took leave of me he had thus staved it off for six months. But it is not every patient who has the intelligence and the strength to make the experiment with his own hand; and we do not as yet possess a suitable compressorium, which might be applied several times daily, even when there are no premonitory symptoms, in order to diminish the current of blood to the head. The instrument which my former pupil, Dr. Lewis, has figured in his dissertation[1] is too complicated to answer the purpose well. At all events, the compression of the carotids and the regulation of the respiratory movements present us with a means by which we may more directly influence the brain than with any other. We have already drawn attention to the manner in which respiratory movements may be employed for the purposes of diagnosis.[2] The case described at vol. II, p. 117, shows that deep inspirations may prevent the outbreak of convulsions; we may equally, therefore, expect benefit from the proper employment of compression.

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[1] Consult—Memoirs of the Medical Society of London, 1792, vol. iii; and Philosophical Transactions for the year 1811, part i, p. 89.

Anæmia more frequently demands our consideration in the treatment of epilepsy than plethora, more especially in the female sex, in whom it is often associated with disturbance of the uterine functions. In the month of December, in 1847, a girl of 15 was under treatment at the Policlinique, who had formerly enjoyed excellent health, and had eight weeks previously been seized with her first attack of epilepsy. A fortnight before applying for relief a second fit had occurred, lasting half an hour, and preceded by violent gastrodynia. For several months the catamenia recurred every fortnight, and continued profuse for from three to four days; the complexion was excessively pale; on the 3d and 9th of January there was a return of the paroxysms. In order to diminish and to regulate the menstrual discharge, I ordered an infusion of sabina, (two drachms to four ounces, taken four times a day,) which I found on previous occasions to produce excellent effects. After an interval of five days the usual aura occurred, followed by a paroxysm which only lasted five minutes, and after an interval of three weeks more the courses reappeared. On the 26th of February the patient was in admirable health; the attacks had remained in entire abeyance for three weeks; after an interval of three weeks and a half the catamenia had recurred regularly, and much less profusely than formerly, and all medicines were omitted. A year later the young woman's health was found to have continued undisturbed. Although the connection existing between local diseases of the uterus and epilepsy has not been actually demonstrated, as in hysterical affections, attention will in future be drawn to the subject, and, if found to exist, the treatment recommended at vol. II, p. 90, seq., will have to be employed.

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[1] De compressione Arteriarum ad complures Morbos sanandos utilissima; Berolini, 1846.

[2] Vol. I, p. 159.

For the treatment of epilepsy depending upon morbid conditions of the liver and the biliary secretions, the springs of Marienbad and Carlsbad,[1] followed by the use of sea baths, are advisable. A young man residing in England had, in consequence of too copious animal diet and absence of exercise, been attacked by the disease, which was at once treated with specifics like nitrate of silver, &c., and only made the deeper inroads. An icteric hue of the face, the phantasm of a yellow spot before the right eye, and vertigo, were the precursors of the attack. The left lobe of the liver was swollen and sensitive to the touch; there was obstinate constipation; the urine was high coloured; the fæces of a brown hue. I advised drinking the waters of Marienbad for three successive years, for four weeks each time; cold washing of the head and trunk; the cold water cure; and, subsequently, the baths; the result was most satisfactory, and it is now eight years since the least trace of the disease has been manifested. Constipation is a symptom peculiar to epileptics, and deserves our especial attention; it very often gives rise to an abuse of drastic remedies. In these cases, cold water enemata are particularly beneficial; and if they do not produce a sufficiently powerful effect, injections of tepid or cold water should be made into the rectum to the amount of from half a quart to a whole one; this serves as a sort of internal bath, which has not been sufficiently appreciated hitherto in the treatment of obstinate and severe nervous diseases.

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[1] [Marienbad and Carlsbad baths, situated in the great volcanic plain of Bohemia, and in great request among the Germans, both belong to the class of mineral waters, the main constituent of which is sulphate of soda; they also contain carbonates of soda and lime, and of some earths, carbonic acid gas, and a minute proportion of iron. They are powerful solvents and purgatives, acting specifically on the lymphatic and urinary organs. The waters of Carlsbad are much more heating and stimulant than those of Marienbad, and if used without proper precautions may produce dangerous effects.]—Ed.

If the choice of our therapeutic proceeding is made with a due regard to the relation that may exist between an interruption of cutaneous affections and epilepsy, it is often crowned with remarkable success. A man of 45 years, who was a patient of the Policlinique, had suffered from scabies in his early youth, from which he had rapidly recovered. For seven years previous to coming under my care he had suffered from epileptic attacks, which at first occurred only during sleep, but afterwards also supervened during the waking state, and induced great weakness of memory. The statement of the patient that from time to time a papular eruption occurred on his body, which, when fully developed, diminished the frequency and intensity of the epileptic attacks in a marked manner, particularly attracted attention; and in accordance with this hint from nature, a bath of sulphuret of potash and friction of several parts of the body with a liniment containing castor oil was ordered. Internally a remedy, much lauded by the older physicians in similar cases, the tinctura Jacobi, (liquor saponis stibiati,)[1] was administered, and continued in increasing doses from fifteeen to twenty-five and thirty drops, for a considerable time. The treatment was effectual; for the attacks which formerly returned almost every fortnight, have since disappeared, and it is now more than a year since they have shown themselves.

The second indication for the radical treatment is to restore the nervous system of the individual to its normal condition. We must strive to solve this problem in those cases in which no cause is to be discovered, as well as in those in which, after removing the exciting cause, the disease yet continues. Our chief guide must be the pitch of the irritability. If the character of the nervous system we have to deal with is one of erethism, and especially in the female sex, and in infancy, a milk and vegetable diet should be recommended. Cheyne[2] relates the case of a celebrated physician, who himself suffered from epilepsy for a considerable time, and used numerous remedies without benefit. As he perceived that the attacks occurred the less frequently the fewer and the more digestible articles of food he consumed, he confined himself entirely to milk; he took a pint of milk in the morning, another in the evening, and two in the middle of the day; taking nothing besides but water. He continued this diet for fourteen years, and entirely recovered from his epileptic attacks, an instance of abstemiousness which is not often to be met with among our professional brethren. If there is great erethism we may also use the grape cure. On the other hand, if we have to deal with a torpid subject, he requires to be roused by stimuli, which act upon the central organs and the peripheral distributions of the nerves. Our sheet anchor in these cases are cold baths, plunging and shower baths. If it were in our power to limit the effect of powerful mental emotions, and especially of fright, we should be more successful in our treatment of these varieties of epilepsy. The older authors recommended, upon this principle, to let the patient see the execution of criminals, and drink the warm blood of the malefactor. A powerful derivative should be applied in the vicinity of the head, at the occiput, or near the first cervical vertebra; the most suitable means of doing so is a seton, and it is most important that the suppuration should be kept up for a series of years. I have repeatedly found the physical and intellectual condition of the patient improved by its use, the frequency of the paroxysms diminished, and even in a few instances a permanent cure obtained. Among these I may mention the case of a boy of 11 years, who had been subject to epilepsy, accompanied by slight paralysis of the right extremities and dementia, for a year, in consequence of which his schoolmaster insisted upon his removal from the school. Many remedies had already been applied in vain. The cranial bones were found much hypertrophied. As a scrofulous habit existed, the iodide of iron, gradually increased from one sixth to one half of a grain, was given twice a day, and a seton introduced in the nape of the neck. An improvement was perceptible after a few weeks; the paralysis had ceased after six months; the intellect developed itself, and the epileptic attacks did not return. Two years later the boy was presented to the students of the Policlinique, in the full enjoyment of his health.

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[1] [Sapo stibiatus is a soap containing the golden sulphuret of antimony, which, when dissolved in caustic potash and cinnamon water, forms the tinctura Jacobi.]—Ed.

[2] Essay on Gout; London, 1724, p. 103.

As regards the remedies, much perseverance and judgment is required. Fifty-three years ago they had already accumulated to such an extent as to fill 150 quarto pages in Hemmings' 'Analecta Literaria Epilepsiam Spectantia;' they have since been considerably augmented. Among this farrago there are but very few to which the practitioner of experience turns with confidence. Among the vegetal drugs, the Valeriana Officinalis, which has been spoken of by Aretæus and Dioscorides, is to be recommended. It is not a little in favour of the remedy, that the man who reintroduced its use, the Neapolitan Fabius Columna,[1] was himself cured by it. The most suitable form is the recently-prepared powder of the root of a plant, growing in elevated spots, taken in doses of from half a drachm to three drachms daily. Among the metallic preparations we have chiefly to mention the nitrate of silver, for the virtues of which I am able to quote the high authority of the late Dr. Heim, who has assured us that he found it the most effectual remedy during the course of a professional life of sixty years. The renewed exhibition of nitrate of silver in epilepsy, (it was originally recommended by Angelus Sala at the commencement of the seventeenth century,) was introduced by British physicians, Wilson, Harrison and Paget; they use larger doses than are customary in Germany, and have found doses to the amount of one, two, three, and even six grains, given in pills, three times a day, to produce satisfactory results.[2] Powell has found that the stomach bears a threetimes larger dose in the solid than in the fluid form.[3] It is advisable to begin with small doses of a quarter of a grain, to increase the quantity gradually, and persevere with it. The blue discoloration of the skin, to which the late Dr. Albers of Bremen and Dr. Roget were the first to direct attention, bears no relation to epilepsy.[4] The ammonio-sulphate of copper and the sulphate of zinc are less efficacious, though of late the sulphate of zinc has been recommended as effectual by Drs. Bright and Addison,[1] if given in doses, gradually increased to a scruple and half a drachm, three times a day.

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[1] Phytobasanos. Neapol., 1492.

[2] John Cooke; History and Method of Cure of the various species of Epilepsy; London, 1823, p. 142.

[3] Medico-Chirurgical Transactions, vol. iv, p. 85.

[4] Ibid., vol. vii, p. 220.

Therapeutic attempts will fail unless supported by a strict mental and bodily regimen.[2] The strongest proof of the influence of mental dietetics is given in the fact, that even in inveterate epilepsy the hopes excited by a change of the physician and of treatment may prolong the intervals between the fits, and even give rise to a pause. Esquirol[3] states the same, in the following terms:—Toujours une nouvelle médication suspendait les accès pendant quinze jours chez les uns, pendant un mois, deux mois chez d'autres, et même pendant trois mois.

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[1] Observations on Epilepsy,—in Guy's Hospital Reports, vol. vi, p. 17.

[2] Consult Diætophilus; Physische und Psychische Geschichte seiner siebenjährigen Epilepsie; Zürich, 1798.

[3] Loc. cit., p. 319.

CHAPTER XXXIII.

TREMORS.

That neurosis of motility, which goes by the name of tremors or trembling, forms, as it were, the bridge which conducts from the region of convulsions to the paralyses. On this subject Volkmann[1] makes the following remarks:—"Henle has already adopted the view of muscular tonicity, being a state of continuous and moderate excitement. That this excitement depends upon a continuous succession of stimuli, is proved by the fact that we are able to restore the tone of a muscle which has been lost in consequence of the division of its nerve, by a very rapid succession of stimuli. This is effected by exposing the divided motor nerve to a very weak current of the magneto-electric rotatory apparatus. The stimuli follow one another so rapidly, if the wheel is turned round with sufficient rapidity, that the operation of the second commences before that of the first has entirely ceased. The motor impulses of the spinal cord must take place with at least the same rapidity, in order to produce the constant contraction, which we call tone. If the stimuli do not follow one another with sufficient rapidity, the muscle has time to relax, and this is probably the explanation of the tremor of old age. We are, in fact, able to produce the tremor artificially, if we place the spinal cord of a decapitated animal in connection with the weak current of a magneto-electric apparatus, and make the revolutions rather slower."

Tremulous movements of muscular organs take place with varying force and intensity, they not unfrequently follow each other with a certain rhythm, and with great rapidity; there is an arrest of the affection during sleep, and while the parts are supported; it is increased by voluntary movements and emotions, while the motor force and endurance are at the same time diminished. The muscles of the extremities of the trunk and of the cervix and tongue are the most frequent seat of tremor, which is either limited to individual groups, or involves several at once. Nystagmus, for instance, is generally nothing but a tremulousness confined to the recti externi and interni, and in the muscle of the lower eye-lid we not unfrequently have opportunities of observing the tremor of individual layers of muscle.

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[1] Wagner's Handwörterbuch der Physiologie, Art. Nervenphysiologie, p. 488.

Complications with other morbid conditions of the nervous system occur frequently, with insanity in delirium tremens, with an abnormal balance of movements in paralysis agitans, and with a loss of the cerebral conducting power of motor nerves in paralysis.

Advanced age affords a predisposition. Mercurial vapour is a specific cause of the affection, poisoning with lead acts less frequently; it is also induced by alcohol, and venereal excesses and masturbation. Fevers, mental emotions, and debility during the period of convalescence and after profuse discharges, act as occasional causes.

MERCURIAL TREMOR.

This disease[1] rarely commences suddenly, but generally by degrees; first seizing the arms, then the legs, and at last the tongue, both in its masticatory and articulating functions. The shaking and trembling, especially if the causes continue to operate, degenerate into violent shocks, which interrupt and prevent the execution of voluntary movements. If a patient of this description desires to bend his arm, he finds himself unable to do so at once, but succeeds by making two or three pauses; if he attempts to drink, he spills the beverage; he is unable to introduce the food into his mouth, and requires to be fed like a child.[2] The speech becomes indistinct and thick; the tremor is increased by emotions; the complexion has a grey hue; the skin is dry and rather hot; emaciation occurs rarely; the abdomen is soft; the evacuations unaltered; much flatus accumulates in the intestines, and is discharged upwards and downwards; there is loss of appetite; and the pulse resembles the pulse of lead colic, being hard and slow.

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[1] Tanquerel des Planches; Traité des Maladies de Plomb ou Saturnines; Paris, 1839, vol. ii, p. 33.

[2] See—Mérat; sur le Tremblement auquel sont sujets les doreurs sur Métaux, et les autres ouvriers qui comme eux emploient le Mercure, in his Traité sur la Colique Métallique; Paris, 1812, p. 273.

The disease generally lasts a long time. A perfect cure is rarely established; a slight tremor generally remains; a complication with other diseases is very rare, and the issue is scarcely ever fatal.

The malady is produced by mercurial vapour volatilised at the ordinary temperature of the atmosphere; its action is still more violent if volatilised by fire. Faraday states that a plate of gold attached to the mouth of a bottle, upon the bottom of which there is a small quantity of mercury, speedily becomes covered with amalgam.[1] Gilders and workmen in quicksilver mines are, therefore, most exposed to the disease; then the manufacturers of looking-glasses, meteorological instruments, jewellers, and brassfounders. The external and internal administration of mercury, only in exceptional cases, produces such effects; on the other hand, mercurial tremor is rarely accompanied by salivation.

The prophylactic measures against mercurial tremor have been rendered much more secure since Darcet introduced the blast-furnaces into bronze and other manufactories. Fresh air and cleanliness are protectives; and the workman should be cautioned to avert his face as much as possible from the vapour during his work. When the disease has actually appeared, the chief condition for recovery is the avoidance of the cause; the individual must give up his employment for a time, or for ever. Dr. Haen[2] found the most positive benefit in the employment of electricity; he has communicated nine cases in which a cure was obtained without any other adjunct. Country air, warm baths, opium and decoction of sarsaparilla, are recommended by Mérat. Sulphur taken internally and used in baths is also advisable, as well as the salts of iron and quinine.

TREMOR POTATORUM.

In drunkards, the head, tongue, and lips, are most liable to tremor; the movement is strongest and almost convulsive when they wake up, or when they are sober. Attempts at treatment almost invariably fail, from the inability of the patients to resist the temptation to resume their bad habits.

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[1] Christison; A Treatise on Poisons, 3d ed., p. 391.

[2] Ratio Medendi, vol. iii, p. 201.

TREMOR SENILIS.

Besides the extremities, it is chiefly the head, which in aged people is subject to the tremor, and females are more liable to it than men.

TREMOR FEBRILIS.

In febricitations and rigors, especially of intermittent fevers, besides the muscles of the trunk and the extremities, those also of the masticating muscles tremble. According to Magendie's[1] experiments, the withdrawal of the subarachnoid fluid of the spinal cord in living animals, and its reinjection at a lower temperature, produce similar trembling and agitation.

PARALYSIS AGITANS.[2]

Dr. Todd[3] describes the disease in the following terms:

"The disease approaches gradually and almost imperceptibly, generally commencing with a sense of weakness and slight tremor of the hands and arms, and occasionally of the head. After a lengthened period, perhaps a year, the patient loses his balance in walking, and bends forwards. The feet are powerless and tremble. The tremor becomes permanent, overpowering, and does not even cease when the parts are firmly supported. Head, hands, and feet, are in constant tremulous movement. When the patient attempts to walk, he throws himself upon the toes and front of the foot, walks hastily and insecurely, in constant danger of falling on his face. The tremor now continues during sleep, and becomes so violent that the bedstead shakes, and the patient wakes up. He is unable to read or to write, and being unable to eat by himself, requires to be fed. Mastication is difficult, the saliva flows from the mouth. There is constant constipation, the trunk is bent forwards, the chin rests on the sternum. At last, there is entire loss of speech and deglutition, involuntary evacuations, sopor and death."

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[1] Leçons sur les Fonctions et les Maladies du Système Nerveux, vol. i, p. 111.

[2] Parkinson; Essay on the Shaking Palsy; London, 1817.

[3] Cyclopædia of Practical Medicine, art. Paralysis, p. 259.

The disease is one of advanced age. Its causes are unknown. Parkinson, in one case, found the medulla oblongata, the pons Varolii, and the cervical portion of the spinal cord, indurated. I have often had the opportunity of observing this form of tremor. One patient of mine, a woman, 53 years of age, had been affected for several years. The rhythmical agitation of the hands, arms, lower jaw, and thighs, was most violent. The knees beat against one another as if they were keeping time, and it was necessary to apply a roller in order to arrest the pain and prevent excoriations. The tremor increased the instant the patient assumed the erect posture. By day it was unintermitting, and at night there was some rest during a few hours of sleep. The arms and legs were powerless, but not paralysed. The sphincters retained their power. All the remedies tried proved fruitless; issues ordered by another physician to be applied to the spinal column, together with the endermatic application of strychnia, had only increased the intensity of the disease. In another patient, of 56 years of age, the tremor chiefly affected the head and the lower extremities, and was associated with an inclination to fall forwards. In the Policlinique numerous cases have presented themselves, in which a complication of violent tremor with a disturbed balance of the movements was observed. Two patients, 60 years of age, felt a constant desire to walk or fall backwards, and therefore carried the head strongly bent forwards; one of them, in order to stand, separated his legs widely, at the same time crossing his arms on the back, with the view of offering some resistance to the overpowering tendency to move backwards. In a third patient there was a tendency to fall forwards. In all the cases the vigour of the movements was diminished in a marked manner, and the patients stated that their limbs felt as heavy as lead. With every movement the tremor, which in the first case also extended to the muscles of the lower jaw, and much impeded articulation, increased considerably. In one patient, the cause seemed to be of a rheumatic character; he attributed the origin of his complaint to his having been plundered of his clothes by the Cossacks, in 1813, before Magdeburg, when in a state of perspiration, and left lying on the damp ground for several hours. The second patient had, a year previously, suffered from a quartan ague, which was rapidly suppressed, and was then followed by paralysis agitans. In the third case, the cause could not be accurately determined. The patient who, thirty years previously, had passed through a nervous fever, stated that she had several times been attacked by paralysis of the right side, from which the warm springs of Teplitz had restored her. It is impossible to determine whether these circumstances and eleven confinements, and a life worn out by anxiety and care, presented an etiological relation to the paralysis agitans. I may mention, that this was the only case in which the treatment, which consisted in warm baths, with cold affusion to the head and neck, and in the use of the carbonate of iron, produced, if not a complete cure, a marked diminution of the symptoms. In one case, Elliotson obtained a cure by the persevering use of the carbonate of iron.[1]

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[1] Behrend; Neuste Medic. Journalistik des Auslandes, Band xi, p. 309.

DISEASES OF THE NERVOUS SYSTEM.

CLASS II.

THE DOCTRINE OF THE NEUROSES OF MOTILITY.

SECTION THE SECOND.

CHAPTER XXXIV.

ACINESES.[1]

PARALYSIS.

The definition of paralysis is, weakness or cessation of muscular contraction by diminution or loss of the conducting power or stimulation of the motor nerve.

This gives us the means of distinguishing paralysis from every other immobility of the muscle, with which it is often confounded. I shall not enter into a consideration of that variety of immobility which arises from disorganisation of the muscular and fibrous tissue and from other morbid processes; but I deem it necessary to dwell upon those varieties of immobility which originate in an absence of the normal stimuli of the muscular fibre.

At an earlier part of the work I have had occasion to speak of the arterial blood as the stimulus of contractility, the inherent power of the muscular fibre; and I pointed out that the prevailing energy of the nervous stimulus may be manifested even after the blood-stimulus has ceased to operate. I brought forward as proofs experiments made upon living animals and the asphyxia of cholera. This relation, however, only maintains for a brief space; when the conveyance of arterial blood is arrested for a length of time, and is not replaced by collateral circulation, the loss of contractility is as certain to follow as when the conduction of the motor nerves is interrupted. The cases of arteritis recently described prove this clearly; the following is one which has occurred in my own practice:

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[1] See Editor's note, vol. I, p. 275.

A merchant, aged 29, who generally enjoyed good health, and had lately engaged himself to be married, after an indisposition of a few days, suddenly, in the night of the 20th and 21st of October, 1844, complained of a burning sensation in the lower extremities, which rose upwards towards the head, where it was converted into an overpowering sensation of hissing and boiling; he was almost deprived of consciousness, but he was just able to call for assistance. The physician who was sent for found him with a livid, bloated countenance, and speechless; the left side was almost deprived of motion, the head was confused, and the pulse slow; when the patient was raised, vomiting supervened. A venesection was made, and antiphlogistic treatment adopted. Speech returned on the evening of the same day; only a trifling pain in the head remained, which was increased by movement. On the following days the pulse was accelerated and the skin hot and dry. The patient complained of formication in the fingers and sleeplessness. On the 1st of November, a rigor, followed by heat and perspiration, supervened; and this returned, at irregular times, once or twice daily, and also at night. The urine varied; sometimes it was clear and pale, at others deep-coloured and turbid. On the 4th of November the right foot presented a sense of numbness, which passed off after a few hours under the application of dry friction, but returned on the following day, extending to the middle of the calf, and being associated with coldness, anæsthesia, and difficulty and pain in movement. Dull pains also occurred spontaneously in the deeper-seated parts of the limb. On the 12th of November the warmth and sensibility of the limb were gradually restored, but the foot was dragged in walking; the fever continued and the powers were reduced. The patient now also complained of a sense of tension in the left foot, and of a deep-seated dull pain, which was increased by pressure upon the internal surface of the thigh, and became very violent on the 14th of the same month. The rigors had left him for a few days, but the fever had risen; sleep was altogether in abeyance, and gave place to delirium. The urine often passed off involuntarily, although the patient felt a desire to micturate. On the succeeding days violent palpitations of the heart supervened.

On the 28th of November I was called in to consultation on the case. The left foot and leg were considerably œdematous; pressure of the finger upon the dorsum of the foot left indentations of a blueish red colour. Extensive dark sugillation was found on the external side of the calf. The skin of the sole of the foot was of a dark yellow colour, and towards the toes thrown into thick folds, as we find it in Asiatic cholera. The temperature was much reduced to above the knee. Sensibility was entirely gone, and I was able to insert a needle to a considerable depth without the patient perceiving it, and without discharging a drop of blood. The leg was paralysed, and it was only after repeated requests that the patient bent the large and adjoining toes, and, by moving the thigh, slightly rotated the whole extremity. The normal colour and temperature of the body commenced above the knee. No pulsation was to be felt either in the popliteal or crural artery of the left side; pressure upon the femoral, just below Poupart's ligament, excited violent pain. By the aid of the stethoscope I was enabled to hear pulsation above the navel, but none below. The pulse was also imperceptible in the left radial. No difference was observed in the temperature and sensibility of the arm and hand of the opposite side; but the motor power had suffered, and the patient himself complained of weakness in the limb. The pulsation of the left carotid was less than that of the right. The right leg, which was bent at the knee, presented a moderate warmth. Sensibility was very obtuse, so that the patient was unconscious of contact unless he saw it. Motility was impeded, though not to such an extent as in the left foot. The crural artery pulsated; at the popliteal, pulsation was not to be distinctly discerned. The impulse of the heart was accelerated and strong; a distinct vibration was communicated to the hand. The first sound of the heart was marked by a loud bellows-murmur, which was synchronous with the pulse. The pulse was 120, and compressible; the skin dry and warm; respiration somewhat accelerated, without a sense of dyspnœa; the patient lay equally well on his sides or his back; the bowels had not been moved for twelve hours; the abdomen was tympanitic, giving a hollow sound on percussion; the urine was copious, often passing off involuntarily; the tongue moist, thirst moderate, and the face sunken and pale, the lips especially so. Consciousness proved to be unembarrassed in conversation, but the patient had no perception of his disease; on the contrary, he enjoyed a certain euphoria, and fell into pleasing deliria as soon as he was left to himself.

I explained to the medical gentlemen attending the case that I could not adopt their view as to the disease being an affection of the spinal cord, but that I attributed the paralysis of the inferior extremities to the impermeability of the crural artery and its ramifications, which, at the patient's time of life, if no aneurism is present, can only originate in inflammation, arteritis. Cerebral and spinal paralyses do not commence with disturbance of the circulation; neither this symptom nor the diminution of temperature attain so high a degree in paralysis, nor is there ever an entire absence of pulse in the vascular trunks. In the present instance I apprehended the approach of mortification, resembling gangrena senilis. Judging from the report given me, I considered that the disease had commenced in the right femoral artery, but without blocking up all the collateral branches, as warmth had been restored; that it had extended upwards to the bifurcation of the aorta, from whence it had spread to the left iliac and crural arteries, in which its greater extension had interrupted the circulation entirely. The vivid pain on compressing the femoral artery under the crural arch appeared to me to indicate a continuance of the inflammatory process as a condition of the obliteration. But disease of the arterial system had evidently extended above the diaphragm, and affected the left side of the body; a morbid change in the left side of the heart, in the mitral valve, was indicated by the bellows-murmur, the increased impulse, and the vibration, probably arising from endocarditis;

and it was evident that in the radial artery a similar process to that existing in the crural artery, though less marked and not affecting the collateral circulation, had been established. I stated that the fatal issue was unavoidable, both from the extent of the arteritis, as also because the heart was much implicated, and the vital powers were failing, so that we could not expect the formation of a collateral circulation after the obliteration of the main trunks. I therefore argued that we could no longer think of employing a reducing mode of treatment, and advised the application of aromatic fomentations to the lower extremities, friction with grey ointment to the thighs, and the exhibition of broth and wine.

November the 29th.—During the night there had been silent delirium and a cold perspiration. A dark red ecchymosis is visible on the right knee, the œdema of the left foot is diminished and softer. As far as the warm fomentations have been applied, a communicated warmth is found, ceasing at the knee, the temperature of which is cool. The pulse is 128, small and irregular, the skin moist and moderately warm. The tongue dry at the tip and down the middle. Consciousness untroubled. Urine and excrements pass off involuntarily, but the patient always feels the desire to micturate. The position of the body is on the right side, and a change of posture is impossible without the assistance of the attendant. The right leg is bent at the knee.

November the 30th.—The right leg is painful when moved; when at rest the patient complains of painful tension in the limb, although there is complete anæsthesia to external irritation. The epidermis is desquamating at several spots, also on those that are ecchymosed. An ecchymosis has formed on the left knee, extending to the middle of the thigh, which is now also cool and deprived of sensation as far as the edge of the glutæi. There is incipient decubitus at the sacrum. The bellows murmur in the heart continues. The tympanitic distension of the abdomen has increased, in spite of three watery alvine discharges. In the course of the day he was frequently delirious. A decoction of bark with acetic ether and warm fomentations to the legs with vinegar, were prescribed.

December the 1st.—During the night the delirium has continued without intermission; towards morning the skin was covered with perspiration. Two large dark ecchymoses are visible on the anterior surface of the right leg. The anæsthesia extends to a few inches above the knee; from this point the sensibility is dull. The power of motion is entirely gone in the leg. Decubitus shows itself on the right trochanter, upon which the patient has lain during the night. The distension of the abdomen has increased, respiration is accelerated, but there is no dyspnœa. The pulse of the left radial artery may be felt at the wrist, but very feebly. There is a tendency to somnolency, slow utterance and collapsed features.

December the 2d.—Constant delirium during the night; for a few hours general warm perspirations; by day somnolency, subsultus tendinum, respiration much accelerated; the pulse in the morning 116, towards evening 128, very small and vermicular, the tongue dry and cool, the abdomen tympanitic, constant tenesmus, and ischuria. At the right leg, which is shrivelling up more and more, the epidermis has peeled off on the ecchymosed spots and in their vicinity; the cutis is black, dry, and coriaceous. The decubitus at the sacrum has increased, and reached the left trochanter. There is withal great euphoria, so much so that the patient asked permission to get up and write a letter.

December the 3d.—Respiration is much accelerated, superficial and sonorous; the bellows murmur and the heart's impulse are weaker; the pulse, which is 120, almost vanishes under the finger; the surface of the trunk is moderately warm, the cheeks and nose cool, and the tongue dry. The right knee is strongly flexed, and cannot be extended. The mummification of the leg has extended; a large blister has formed upon the left knee. The superficial veins are felt like broad cords, passing equally through the ecchymosed portions. The œdema is less and softer; the crural artery feels like a hard cord, and is tender when touched.

December the 4th.—The night has been very restless; with constant delirium, six pultaceous and involuntary evacuations and copious general perspirations. When addressed the patient answers, but his thoughts soon become confused and he wanders. Respiration is short and noisy; the alæ nasi move convulsively; the pulse is 124, feeling like an empty channel;

the tongue is dry, covered with aphthæ at the tip and the edges, and deglutition is impeded. The pulse of the left radial is imperceptible; and the bellows murmur in the heart has ceased. The congestion of the veins has extended up to the thigh; they form a network of broad dark brown striæ, which are also perceptible to the touch; the saphena magna is particularly prominent. The ecchymosis, which covers the entire inner surface, has assumed a darker hue. Several blisters have formed on the leg. The right leg has become more emaciated; the mummified portion has extended, and the surrounding skin presents a dark purple colour. The sensibility of the right thigh generally is much reduced, but at the same time pressure upon the crural artery causes much pain.

December the 5th.—The patient is more collected, but his articulation is thick and unintelligible. The respiration is very quick and short; the pulse 124. The urine, which has been caught up by the attendant, is copious, clear, and slightly acid. The gangrene is extending rapidly. The epidermis is peeling off from the left leg; the exposed cutis is as black as a coal and pulpy, the muscular tissue has passed into fetid putrefaction. Large and profound sphacelation has formed on the leg and heel. An extensive gangrenous spot has appeared on the dorsum of the right foot; the epidermis is detached, and the subjacent cutis is black, horny, and corrugated. Sopor ensued, and at four o'olock on the ensuing morning death terminated the scene.

The cadaveric examination was conducted, thirty hours after death, by Professor Froriep. The cavities of the pleura contained a small quantity of a reddish-coloured serum. With the exception of the cadaveric stasis in the lower lobes, both lungs were perfectly healthy. The pericardium was much distended, and filled with from five to six ounces of fluid. The heart was enlarged, and the left ventricle hypertrophied. A pale red firm coagulum was found in the right ventricle; a larger coagulum was found in the left, and it contained more cruor. A rounded excrescence lay between the two flaps of the mitral valve, attached to the upper one, an inch and a half in length and of a yellowish colour, almost blocking up the auriculo-ventricular orifice. The aortic valves and the inner surface of the ventricle were normal. In the arch of the aorta there were small cartilaginoid indurations; there were some also along the thoracic aorta, causing prominent longitudinal striæ upon the internal coat.

The stomach and intestines were much distended by gaseous contents. In the tissue of the spleen, beneath the peritoneal investment, there were three plastic exudations of a whitish colour and of trifling extent.

In the abdominal aorta there was, close to its division into the common iliacs, a firm pale red coagulum, which completely closed up the artery, and adhered firmly to the inner coat, which was smooth and pale. This plug was continued into the two iliacs, and terminated in a fine conical point. Where the left internal iliac passes off, a similar exudation was found, of the same density but of a lighter colour. The left external iliac was blocked up with a thinner coagulum containing much cruor, up to the point at which it passes under Poupart's ligament; it was easily detached from the internal membrane, which itself was thickened, reddened, and pultaceous, and could easily be separated from the middle or fibrous coat. The fibrous coat and the external cellular sheath were also thicker, and more lacerable than they are in the normal condition. There was plastic exudation between the membranes, which could easily be perceived in the tissue surrounding the arteries. The latter was strongly inflamed below Poupart's ligament, and the lymphatic glands of this region were also much swollen and reddened. At the point where the profunda femoris is given off from the femoral artery, there was a firm plug, which could only with difficulty be separated from the inner membrane, which presented a deep colour; a prolongation of this clot extended into the profunda, so that the coagulum resembled a tooth with two fangs. The further course of the femoral was filled with a thinner coagulum, containing more cruor, and its internal coat was villous, rough, and much reddened. Lower down it was free; but at the point where it passes through the adductor magnus, it was again firmly closed by a firm pale plug, the inner coat being much reddened, pulpy, and swollen.

The saphenous vein of the left thigh was narrow and contracted, and the lining membrane pale and corrugated. A trifling exudation of lymph was effused into the cellular tissue surrounding it, which was much inflamed. The crural and common iliac veins were normal.

A firm pale red plug, intimately adherent to the inner coat, was found in the brachial artery, immediately above its division into the radial and ulnar, extending about half an inch into each branch. These were narrow, and their inner coat was somewhat rough and reddened. The radial contained no coagulum in the remainder of its course. The left subclavian and carotid arteries were normal.

Forty-eight hours after the post-mortem, Professor Müller had the kindness to accede to my request, to examine the heart and the arteries more minutely.

The section of the tumour at the mitral valve exhibited a fibrous structure, and proved under the microscope to be made up of fibres of cellular tissue. It was seated beneath the endocardium, which extended from the auricle over the tumour into the ventricle. The yellowish-white coagulum in the lower portion of the right crural artery was impregnated with a fluid of the same colour, in which the microscope showed numerous corpuscles, which, however, did not correspond to pus globules. A thin layer of plastic lymph covered the arterial coagula, which in many parts also invested the inner coats of the arteries. The internal coat of the arteries had become darker than it was on the day of the post-mortem; it was extensively detached from the middle coat, and in some parts a distinct layer of lymph was found between them.

The causes of this mighty disease are enveloped in obscurity: no violent fatigue, no excess of any kind had preceded; it was equally impossible to show the presence of any dyscrasia. After the death of the patient his brother informed me that since his engagement a remarkable psychical change had taken place in him. Formerly he had been phlegmatic and indolent; he had since become animated and excited, and had sat up whole nights writing letters and verses to his betrothed. The same subject had frequently and earnestly occupied him while on the bed of sickness. We can only form a conjecture as to the commencement of the disease, as we do not possess an accurate history of its early stages. The co-existence of the disease in the central organ of the circulation and in several arteries is an essential feature. Still the existence of advanced organisation in the deposit on the mitral valve appears to prove that it originated in the heart. It is to be regretted that the cerebral vessels were not examined, as several symptoms seem to indicate that they were involved at the commencement of the disease; while the delirium occurring during its course, the absence of subjective symptoms to be expected where there was so much impediment to the circulation in the heart, the trifling character of the pain, and the entire misconception on the part of the patient of the nature of his malady, show that the brain was in an abnormal condition. I do not venture to determine the relation which existed between the endocarditis of the mitral valve and the inflammation of the crural artery, which took place on the fifteenth day in the right, and subsequently in the left leg; it certainly was not by continuity of the inflammatory process, and its extension from the left ventricle; the healthy state of the thoracic and abdominal aorta, is opposed to this view. Did a similar process obtain to that occurring in phlebitis? Might there have been a detachment and propulsion of portions of the exudation matter deposited in the heart, which, being arrested in some of the arterial channels, acted like foreign bodies, and excited coagulation of the blood and inflammation? Rokitansky describes secondary processes accompanying endocarditis, which manifest themselves by exudations in the spleen and the kidneys; in the present instance there was also exudation matter in the spleen. Or was there rather an idiopathic disease of the blood, causing foci of inflammation to form at various points of the arterial apparatus.

I turn from the unsatisfactory range of pathogenetic opinions to the diagnostic and physiological results afforded by this case. The inflammation of the arteries was rendered manifest by characteristic features, which presented themselves during life, as well as after death. The post-mortem appearances indicative of arteritis are:—1. The lymphatic exudation covering the inner coat of the arteries at numerous points, intervening between the coats, and even in part investing the coagulum. 2. The tumefaction, softening, and friability of the separate vascular coats. 3. The coagulation of the blood at all points corresponding to the seat of inflammation, though varying in amount, but in a direct ratio with the duration of the disease;

in some places there was a firm plug of a pale red colour adhering to the lining membrane, and completely occluding the calibre of the artery; in others, there was a thinner coagulum, containing cruor, and easily detached; on the left side the external iliac and all of its branches were blocked up in this way, the right iliac being free. 4. The right femoral, in which the inflammation commenced, showed a tendency to obliteration; it was narrowly contracted, and the inner coat corrugated. 5. The cellular tissue in the vicinity of the arteries, *e. g.* under Poupart's ligament, was much inflamed, and the lymphatic glands situated there were found reddened and swollen. I mention the reddening last, as it may be explained away as the result of imbibition; still the fact that it was not uniform, but only partial, and that it was more intense seventy-two hours after death than on the day of the sectio cadaveris, endues it with a special value. The implication of the left saphena explains the difference in the character of the gangrene; it was moist and œdematous in the left; dry (mummification) in the right lower extremity.

The symptoms during life indicated an impediment to the current of the arterial blood caused by arteritis, for which there was no supplementary action by the collateral circulation; it was marked on the one hand by a stony coldness, lividity, pulselessness in the arterial trunk, and tenderness of the same on pressure; on the other, by anæsthesia and paralysis. This combination of phenomena, which showed the impairment of the two great supporters of vital action, was apparent from the beginning, and should challenge us to make accurate investigations, in order to prevent our confounding the disease under consideration with spinal and cerebral paralysis.

In horses an inflammation of the femoral arteries and abdominal aorta has also been repeatedly observed[1] and diagnosed even during life. The symptoms are:—at first weakness of one or both hind legs when hard worked, while no difference is perceptible when the animal is at rest, in walking, or trotting. If the attempt is made to force the animal to go on, it manifests great anxiety, breaks out into profuse perspiration, and only the lower part of the back and the hind legs remain cool and dry. The animal can only drag its legs on. If it is then allowed a few minutes' rest, it drags its legs one after the other under its belly, and drops them, at the same time exhibiting great restlessness. If again made to move, it trembles over the whole body; the pulse and respiration become much accelerated, and the animal is incapable of further progression. No pulsation is felt in the arteries of the hind legs. The animal speedily recovers if left to itself. As the disease advances, the paralysis becomes more marked; after a short trot he falls down, is unable to rise, and the legs are deprived of sensation, so that even the application of moxæ is not felt. Such horses are soon killed; it is therefore not known whether gangrene would supervene, as it does in man.

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[1] Gurl's und Hertwig's Magazin für die gesammte Thier-heilkunde, 4 Jahrgang, 1838, p. 455; 9 Jahrgang, 1843, pp. 221, 461.

The connection between the development of paralysis and the interruption to the arterial current in arteritis, a symptom which distinguishes it in a marked degree from phlebitis, is a subject of physiological interest. Operations and experiments had already afforded analogous results. When the ligature has been applied to larger arterial trunks for the purpose of curing aneurism, numbness, formication, and a diminution and loss of motility supervene, symptoms which endure until the collateral circulation is established. Paralysis of the hind legs, after tying the abdominal aorta in dogs, has been observed by Shenson, Bichat, and Emmert; the same has recently been noticed by Engelhart in frogs. The question suggests itself, whether the interruption of the circulation acts directly upon the muscles or indirectly through the nerves. The cutaneous anæsthesia accompanying the paralysis would seem to speak for the latter, as well as the symptoms accompanying arteritis, produced by the injection of irritant substances into the crural artery of living animals. In these experiments Cruveilhier observed, that so long as the circulation was not completely interrupted, the animal gave evidence of violent pain, and was very restless, but that these symptoms ceased after the complete obliteration, and gave place to anæsthesia and paralysis. On the other hand, the capability of moderate movement and of retaining the erect posture, in spite of the obliteration of the vessels, is a proof that the absence of arterial blood, as a vivifying stimulus of the contractile fibre, is the cause of the incapability of undergoing greater exertion.

The preceding facts and remarks show the necessity of paying close attention to the condition of the arterial circulation in paralytic affections. From this we may expect an advance, not only in point of diagnosis, but also in therapeutics; and the arteritis, which has been much neglected hitherto, in comparison with the allied disease phlebitis, will receive its proper place in pathology. Nor is it uninteresting to find that the same materia peccans is capable of producing arteritis with gangrene, convulsions, anæsthesia, and paralysis. The poisonous influence of secale cornutum has manifested itself under the first form as ergotism in some provinces of France and Switzerland, in the second form as the creeping disease in Germany and Sweden.[1]

Besides the arterial blood, the absence of direct nervous stimuli may induce a weakness of movement and immobility, which, if the paralysis continues for a time, may pass into a loss of motor conducting power. The first element in this consideration is the absence of cerebral excitement. If motor tracts are not opened from the commencement by the mental impulse, immobility results. The most palpable instance is afforded by the external ear. This organ, which is so essential a feature in the expression of animals, remains motionless in man. The muteness accompanying congenital deafness, or deafness that is early acquired, and the dulness and imperfection of speech in idiots, may also be quoted as instances. On the other hand, we see that physiologists of strong mind and great power of will are able to produce action by motor nerves, which other men have no control over. Mascagni, Gerardi, and other eye-witnesses, affirm that Fontana was not only enabled by practice to move the iris and auricular muscles, but that he could at will retard or accelerate the beat of his heart without marked movement of the muscles of respiration. Professor Müller has even acquired the power of rendering the tensor tympani tense at will. Perfection of execution is nothing but the manifestation of extreme development of certain tracts for the stimulus of mental conceptions. If we could secure similar perseverance for the purposes of health, the progress in our treatment of paralytic conditions would probably be much greater than it is.

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[1] See—Hecker; Geschichte der neueren Heilkunde, 1839, pp. 287—349; and Tiedemann, von der Verengung und Schliessung der Pulsadern in Krankheiten, 1843, p. 273.

The next point to consider is the absence of sensory stimuli. Panizza's[1] experiments were the first to show the influence exerted upon movement by division of the sensory roots of the nerves of the hind leg, near the spinal cord, in goats. Owing to the loss of sensation the foot moves more slowly and is dragged, it bends easier than the other under the weight of the trunk; an hour after the operation the movements are so tottering that the animal easily falls upon the injured limb. A similar relation is found to prevail not only when the perception of the cutaneous and muscular sensations has ceased, (see vol. I, pp. 200 and 225,) but also when centripetal conduction, of which we are unconscious, is arrested. In order to comprehend these conditions of immobility, which hitherto have scarcely met with the attention they deserve, the reader is reminded that the great mass of centripetal nerves in the organism, whose activity we must look upon as continuous, forms a perpetual source of stimulation for the central organs. These stimuli of the inner world, which in variety and power are analogous to or even stronger than those of the external world, also excite the motor energy and induce movements which of late have been termed reflex movements. Certain phenomena in the motor sphere correspond to their excess, or to their diminution and arrest; neither experimental physiology, however, to which we owe so much, nor pathology has especially directed attention to this subject; it is one of great difficulty, as the absence of centripetal excitement is often concealed; and, on the other hand, reflex immobility often passes into complete inexcitability of the motor nerves. Arrest of reflex action, while movement continues to be induced by a mental impulse, forms a characteristic feature of the derangement. Thus the winking of the eyelids ceases when the ophthalmic branch of the fifth pair is attacked with anæsthesia, however much we may stimulate the conjunctiva; at the same time the will may execute the movement without difficulty. The patient, who in Asiatic cholera has lost his voice, utters a loud scream when tortured with pain. The altered balance of the movements of the eye in optical anæsthesia, results from the absence of the animating influence of the sensual excitement upon the oculomotor; if the amaurotic subject resolves to do it, he is able to direct the eyeball that is rotated outwards, inwards. I have attempted, in the following descriptions of the paralyses, to draw attention to the arrest of reflex movements, and to form a group of spinal paralyses originating in this manner, and constituting paralysis of the reflex system.

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[1] Versuche über die Verrichtungen der Nerven, transl. by Schneemann, p. 56.

Among the symptoms of paralysis, those manifested in the muscular and contractile tissue generally are most marked. The loss of all tension in contractile fibres is most conspicuous in the paralysis of the facial nerves; in one case, I found that all the furrows of the affected half of the face and forehead had disappeared within ten minutes after the malady had supervened. The skin becomes flabby and faded, the cheek is pendulous, and when an attempt is made to blow, is distended more easily than the healthy cheek. In an unmarried female, who was paraplegic, I found that the abdominal parietes hung down like an empty bag. There is another symptom of muscular paralysis, which we should meet with more frequently, if we did not neglect to examine the naked body, and which I have seen in several instances; I allude to the oscillation of the muscular fasciculi, similar to the play of the voluntary muscles in animals whose spinal cord has been destroyed. Not less characteristic than the arrest of movement in the paralysed muscle is the contraction of its antagonist, or of the symmetrical muscle of the healthy side; paralysis of the facial muscle, of the muscular nerves of the eye, of the nerves of the respiratory muscles of the trunk, and of the nerves of the extremities, afford sufficient examples of this. Distortions and disfigurements result, which often at first sight indicate the seat of the paralysis, and offer a point of physiological interest, by giving a proof that even in a state of repose, a constant current of the motor power passes from the central apparatus to the muscles by nervous conduction, and that the symmetrical balance must be looked upon as one of those adaptations by which the manifestation of those otherwise visible and sensible movements is prevented. We not unfrequently meet with contractions in the paralysed muscles, whether of a permanent or temporary character. The latter is the manifestation of a coexistent irritation of the nerve tissue in the peripheral or central tract, and pro tanto a diagnostic sign of an inflammatory process, softening or carcinoma; whereas, in mere pressure by means of tumours, or in rupture of the fibres, *e. g.* in cerebral hæmorrhage, the paralysed muscles are free from contraction. We find convulsive agitation of the paralysed muscles occur less frequently than evanescent contractions. The permanent contraction with stiffness of the joints and predominance of the flexors must be looked upon as a residue of the paralysis. In such cases I have seen the heel sometimes touch the nates, and the fingers so firmly closed, that fossæ form for the reception of the tips of the fingers, and that violent attempts at opening them fail. The affection is analogous to the shortening of the muscle which remains as a residue of the spasmodic process, and depends upon abnormal conditions not only of the muscular tissue, but also of the ligaments and bones.

The implication of the sensory function in paralysis is manifested in various ways. 1. Conscious sensation is either extinct, it continues, or is exalted. When cutaneous and muscular sensation continues, the patient has a sense of numbness, or oppression, as if a weight were attached to him, or as if the paralysed limb no longer belonged to him; this impression shows itself even in the dreams and deliria of persons lately paralysed; they dream and talk incoherently of human beings, animals, or inanimate objects, lying upon their paralysed side, which they try to remove, or to throw out of bed. When the disease is more advanced, this is not the case. Diminution and loss of the peculiar muscular sense, the perception of repose and action, is most marked in tabes dorsalis, in which affection sight is called in aid to eke out the defective power of grasping. Anæsthesia not unfrequently accompanies the paralysis of the organic muscles in the organs invested with mucous membranes; there is no sense of the want of micturition in paralysis ischuria, nor of the accumulation of mucus in the bronchi when the vagus is paralysed. We must, however, distinguish between anæsthesia and the absence of perception of cutaneous sensation, as it occurs in cerebral paralysis, accompanying sopor and unconsciousness. An abnormal exaltation of sensibility and painful anæsthesia, like the evanescent contraction of the muscles, indicate a state of irritation of the nerves in their peripheral distribution, or more frequently in their central origin. 2. Unconscious sensibility, or centripetal conduction, is often maintained when conscious sensation is interrupted, unless the affection reside in the peripheral nerves; it is manifested by reflex movements in the paralysed members, as we have already shown. They may also be set in motion by motor irradiation, long after they have ceased to obey the cerebral impulse. These sympathetic movements are especially manifested in respiratory acts; thus the arm of an hemiplegic subject often moves, when he yawns it is lifted up, and retains the raised position until the yawn is over, and then falls down like a dead weight. Bell and Marshall Hall were the first to give instances of this, and I have myself observed several. In epileptic seizures, the paralysed limbs are not spared, and even during mental emotions they occasionally move. No great agitation is required to produce this effect; the case of facial paralysis, given at vol. I, p. 202, shows that the mere sense of the ludicrous may produce this result.

At times, the changes in nutrition in paralysed limbs are marked. The investigations of Nasse, junior,[1] Günther and Schön,[2] have shown that, if after division of a nerve, union of the cut ends is not effected, coincidently with loss and diminution of the excitability, structural changes also occur in the peripheral portion of the nerve, the contents, as well as the walls of the primitive nerve-fibrils being absorbed. In paralytic affections in man and animals, atrophy of the respective nerves, *e. g.* of the vagus, has been found; we do not, however, as yet possess any accurate microscopic investigations of the nerves in chronic paralyses, *e. g.* in congenital paralysis. Alterations in the muscular tissue occur in paralytic, as in every other species of immobility, and have been recently described by Skey,[3] Valentin,[4] and Reid.[5] The last-mentioned author found that seven weeks after dividing the sciatic nerve in a rabbit, the muscles of the paralysed side were much paler, thinner, and softer than in the healthy extremity; the weight of the former was 170 grains, of the latter 327 grains. Valentin states, that when examined by the microscope, the pale greyish white fibre shows the transverse striæ less distinctly, or that they are altogether absent in parts. Nor are they rendered more distinct by the influence of cold water, spirits of wine, or other external influences, which generally bring them out more visibly. The longitudinal fibrils become the more distinct, but even they do not possess the sharp outline, and the firmness of healthy muscular fibre; the fibre appears grey and soft, and resembles healthy muscular tissue, which has been macerated for a considerable time. Subsequently, the fibres that have become thus degenerated disappear in part, so that the muscle diminishes in size. The reduction of volume, which would ensue from this process, may, however, be occasionally balanced by the deposit of a larger amount of fat between the fasciculi that remain. Of all paralyses, those induced by lead poisoning most rapidly induced atrophy of the muscles. It is manifested in an eminent degree in peripheral paralysis of the tongue, and as shown in comparative pathology, in the laryngeal muscles of horses, which are frequently affected with paralysis of the vagus. The atrophy is not, however, confined to the muscle, but also extends to the osseous tissue; in the above-mentioned experiment of Dr. Reid, the tibia and fibula of the healthy joint proved to be 89 grains, while those of the paralysed extremity, were only 81 grains. In congenital hemiplegia and paralysis, or that form which is acquired during the first years of life, the growth of the bones is much retarded, both in the lateral and longitudinal dimensions. Here, as in all cases in which the degree and duration of the muscular activity are considerable, the nutritive derangement is most marked; the emaciation is so great, that the epiphyses of the bones project prominently, the tendons and ligaments relax, and the skin becomes flaccid and dry, even when there is perspiration at other parts of the body. The capillary circulation is indolent, the hue of the surface is therefore bluish red, or very pale, and the temperature below par. Dr. G. von Breuning[1] has noticed that the nails of the paralysed extremity grow very slowly. Where there is also cutaneous anæsthesia, the power of resisting external influences ceases, and decubitus often supervenes, as we see more especially in spinal paralysis.

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[1] Müller's Archiv, &c., 1839, p. 413.

[2] Ibid., 1840, p, 276.

[3] Philosophical Transactions, 1837, p. 375.

[4] Lehrbuch der Physiologie des Menschen, vol. ii, p. 62.

[5] On the relation between muscular contractility and the Nervous System; Edinb. 1841.

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[1] Wiederbelebung erlähmter Gliedmassen durch den Sehnenschnitt, pp. 33 and 41.

The paralysis varies in degree; it is incomplete (paresis) or complete. In the former case, conduction is not entirely abolished, but it is indolent and tardy. We do not possess, nor shall we ever have a standard to measure the velocity of conduction in health, except the contraction of the muscle for the motor, and the perception of consciousness for the sensitive nerve; still, in partial paralysis, the comparison with the corresponding healthy parts may afford some clue. We do not as yet possess any observations on this subject, excepting perhaps, those given in the chapter on paralysis of the tongue, the accuracy of which, does not, however, seem to deserve much reliance. In medical questions, unfortunately, vague statements have been too often admitted as facts. The frequent assumption of partial paralysis, is itself subject to fallacy, as in such cases the determination of the individual groups of muscles is neglected, and the derangement caused by the motility of one, and the immobility of another set, is looked upon as paresis of the entire limb. There is also another point which is not without importance in estimating the measure of paralysis in the upper and lower extremities. In man the legs support the entire trunk, and at once distinctly indicate a diminution of motor power, whilst the pendent arms, which have nothing to carry, exhibit no weakness. In the same manner, therefore, as we institute experiments on the motility of the lower extremities, while the trunk is leaning or recumbent, we ought to test the upper extremities, by holding and swinging heavy articles, or by making the individual walk on all fours; in the latter experiment, we should make allowance for the unusual position.

I have adopted the same division for the discussion of paralysis, as I have for spasms; viz.:

First Order.—Paralyses dependent upon a Loss of the Conducting Power of the Motor Nerves as Conductors.

1. Affections of the cerebro-spinal tracts; the peripheral

paralyses follow the rule of isolated and centrifugal conduction on the side of the affection.

2. Affections of the distributions of the sympathetic. Recent investigations have shown the independence of the sympathetic, and have confirmed the doctrine of the ganglia being central organs, from which direct and reflected stimulation of the motor nerves may result (vide infra), but our knowledge of the pathology of these ganglia is too little advanced to separate them from the peripheral tracts of the sympathetic.

Second Order.—Paralyses dependent upon the Loss of Stimulus of the Central Organs.

1. Affections of the spinal cord.
2. Affections of the brain; in both there is a power of communicating the conditions, and in the cerebral paralysis the conduction takes place in a crucial direction.

The causes of paralyses are only partially known; every period of life is liable to them, from the fœtus to the last stage of existence; there is a congenital and a connate form of paralysis; of the latter we have an instance in the histrionic paralysis caused by pressure of the forceps. During the period of dentition paralysis occurs frequently, both in the lower extremities or in individual limbs, whether convulsions have preceded or not, and they may persist during the whole term of life. Infancy and advanced age are more subject to cerebral, the middle period to spinal palsies. To the latter, especially in the shape of tabes dorsalis, the male sex are much more obnoxious than the female. An hereditary tendency is observed less frequently in paralysis than in other nervous diseases. Paralyses differ from convulsions in their etiological relations by being less frequently based upon anæmia, whilst the continuance of a stronger current to the central organs affords an etiological moment of consequence. It is thus that hypertrophy of the left ventricle favours the origin of cerebral paralysis in itself, and not only by the cerebral hæmorrhage it may induce. A change in the constitution of the blood is more rarely followed by paralysis than by spasms. Lead, arsenic, woorara and tobacco, are substances endued with a specific paralysing power. Among the pathological processes the rheumatic is the most productive of paralytic affections, and in frequency occupies the first position, both in regard to its immediate and its consecutive effects. The interruption and suppression of the cutaneous secretion, by a draught or from getting wet, either paralyse instantaneously or gradually. Instances of the former mode of action are presented to us in facial paralysis, ptosis, or paralytic aphonia; suppression of the copious and peculiar perspiration of the feet, less frequently of the palms of the hands, to which many individuals are liable, affords examples of the latter. In the latter cases there is not so much a metastatic process as the older school assumed, as a coincident affection of the motor and sensitive nerves, a change in their condition of excitement, which gradually reacts upon the central organ. Rheumatism is also of importance in connection with paralytic affections, by the secondary alterations produced in the fibrous tissues, along and through which motor nerves take their course. The internal periosteum of the cranium, the dura mater, plays an important part in this way, it being either primarily affected, or secondarily to a similar malady of the pericranium; it acquires a still further importance by accompanying the cranial nerves. Rheumatic exudation within the sheaths of the nerves, though often spoken of, has not hitherto been met with in the dead subject.[1] The exudation in the cellular tissue of the skin, which Froriep terms a rheumatic node, and which he states to be accurately limited to the distribution of a nervous branch or an entire nervous trunk, has not been confirmed by cadaveric investigation, nor have I met with it during life, although numerous cases of facial paralysis from rheumatism have come to my notice. Syphilitic and scrofulous processes induce paralysis by their influence upon the osseous and membranous envelopes, by producing morbid growths, and by causing tumefaction of the glands lying in the vicinity of nerves. The other pathological processes, inflammation, softening, and hæmorrhage, which are prone to select the central organs for their seat, give rise to paralysis by rupture or by compression of the motor fibres, and not unfrequently mix up symptoms of irritation with those of paralysis. The kidneys, the intestines, and the uterine organs, are the most fertile source of immobility and paralysis; the uterus also acts by the induction of hysterical paralysis. No other class of nervous diseases is so liable to be produced by external injuries as the one under consideration. They operate either indirectly by the induction of other morbid processes, or directly by concussion, compression, or rupture. Concussion by a blow or fall, affects the peripheral or central parts of the nervous system, and even in the first case is rarely confined to narrow limits, but extends through the entire system. Division of a motor nerve, as in cut wounds or surgical operations, and compression, best illustrate the law of isolated conduction; when persons who have suffered amputation of a leg, or cripples, first employ crutches, they experience numbness and a loss of motility in the arms from pressure upon the armpit. If the head is allowed to lie upon the arm during sleep, the fingers are often found numbed in waking.[1] Graves[2] relates the case of a robust man who being much fatigued went to sleep immediately after dinner, his head resting upon his arms, which were crossed on the table. When he woke up one forearm and hand were found to be deprived of movement, and in spite of all the remedies employed, they continued paralysed up to the period of his death, which ensued a few years later. Glandular swellings, morbid growths, aneurisms, dragging cicatrices, give rise to compression. Among the atmospheric influences severe cold may be mentioned as favouring peripheral paralysis, and a sudden fall of the barometer encourages cerebral paralysis. Exhaustion by spermatorrhœa has hitherto been set down as a specific cause of spinal paralysis, and especially of tabes dorsalis, though without sufficient grounds. An important influence is exerted by the continuous use and excessive consumption of motor power, by long continued and fatiguing positions and movements, by epileptic and hysterical convulsions. Mental impressions, especially fright and vexation, bear a close relation to cerebral paralysis.

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[1] Froriep; Beobachtungen über die Heilwirkung der Electricität bei Anwendung des Magneto-electrischen Apparats, 1843, p. 19.

[An English translation of this essay has recently appeared under the title—On the Therapeutical Application of Electro-magnetism in the Treatment of Rheumatic and Paralytic Affections, by Richard Moore Lawrence, M.D., &c.; London, 1850, 8vo, pp. 205.]—Ed.

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[1] See—Robert Henley's Communication, in Guy's Hospital Reports, 1822, vol. iii, p. 253.

[2] A System of Clinical Medicine, p. 410.

A combination of several of these causes is most productive of the malady; it is not to be wondered at, therefore, that after campaigns and great events, like the war of liberation at the beginning of the century, the number of paralytic cases increased materially.

Paralysis runs a more uniform course than other nervous diseases; their general type is one of persistence. They rarely present a periodic character (see the chapter on paralysis of the respiratory muscles of the trunk), with which the occasional increase or manifestation of the paralytic symptoms must not be confounded; thus the paralysis of the nerves of the face is often confined to a few fibres, or it exists only in so trifling a degree, that it is imperceptible while the features are at rest, and only shows itself during their play in respiratory movements. Paralysis of the recurrent nerve of one side, often leaves the ordinary movements of respiration undisturbed; but is at once manifested if violent respiratory efforts are made. When the cause of the paralysis is subject to variations, some variation occurs in the course of the disease; as, for instance, in inflammation or softening of the brain, where improvement, arrest, or exacerbation of the symptoms often alternate with one another.

Paralysis is more frequently chronic than acute; it lasts the shortest time in affections of the sympathetic, longest in spinal and peripheral disease. Those proceeding from the brain vary most, from a few hours, as in hæmorrhage within the brain, to an entire existence, as in congenital paralysis.

The *prognosis* of paralysis is unfavorable; for even if recovery takes place, it is rarely complete; some trace is sure to remain. The amount of danger must depend upon the locality and cause of the affection. If the disease is seated in a central organ, the danger is greater than if it occupies a peripheral tract. Paralysis in the range of the sympathetic is of the most dangerous kind. Disorganising processes and morbid growths belong to the most serious causes. The etiological relations also modify the prognosis which we should form from the localisation of the complaint; thus, facial paralysis, induced by necrosis of the petrous portion of the temporal bone, offers less prospect for recovery than if it is induced by exudation at the base of the brain, or by an hæmorrhagic clot, which is capable of being absorbed. We have next to take into consideration the effects of the paralytic affections; in paralysis of the vagus, the access of the air is impeded, and there are changes in the aeration of the blood; the urine is retained in paralysis of the vesical nerves; hollow muscular organs, such as the pharynx, the stomach, the intestines, become distended, if their nerves are paralysed, and the contents which they ought to discharge are retained (Ileus). The danger is increased by complication, especially with anæsthesia, which ushers in destructive processes, such as decubitus, &c.

The *cadaveric results* of paralysis are as manifold as the diseases which arrest the conduction and excitability of the motor nerves. We have already spoken of the consecutive atrophy of the latter. Much remains to be done by future inquirers; many things will always remain a mystery to us.

The *spontaneous cure* of paralysis is effected less frequently by removing the impediments to conduction in the peripheral tracts, than by restoring the excitability from the central organs. A communication of the complaint occasionally takes place, in consequence of impetiginous affections, and a succession of suppressed or active processes, such as the arthritic or trichomatous.

In our *treatment,* we rarely obtain our end by directing our attention solely to the cause, even if we are in every way able to attack it. We are, it is true, by this means, able to remove obstacles to conduction, such as glands and other tumours, or diseased bone; but after the paralysis has lasted any length of time, these measures will not suffice to restore the dried up fountain of cerebral stimulation, nor to remove the alterations that have been effected in the contractile tissues. Both indications are of great importance; the latter the more so, because, as we have already mentioned, the muscular affection may remain as a residue of the paralysis, and because Reid's[1] instructive experiments have demonstrated that galvanic irritation of the paralysed muscles maintains their irritability and integrity. The nerves of the lower extremities were divided in several frogs, within the spinal column, and galvanism from a weak battery applied every day to one paralysed limb, whilst the muscles of the opposite side were left to themselves. After the lapse of two months, the former showed the normal extent and firmness, and contracted well, while the latter had lost half their volume, and contrasted strongly with their fellows; they yet possessed some contractility, but there is no doubt that had the experiment been prolonged, it would, owing to absence of nutrition, and to change in the muscular tissue, have entirely disappeared. All remedies which have for their object the restoration and maintenance of the integrity of the muscles, are therefore indicated in the treatment of paralysis; they are friction, champooing, and particularly electricity, the currents of which, obtained by induction with the electro-magnetic apparatus, are to be preferred to the electricity produced by friction and contact.[2] The antiparalytic effect of electricity seems to me to rest rather upon the vivifying influence it exerts upon the change of matter that occurs in the muscular tissue, than upon its effect upon the nerves, which only enter into consideration as an agent of conduction; as even when the nerve is destroyed, as Reid's experiments demonstrate, the effect does not fail. For this reason, it is most efficacious in metallic paralysis, in which the nutritive derangements of the muscles attain a high degree, and in those conditions in which the muscular affection continues as a residue of the former paralysis; whereas it never can avail anything, while the excitability of the central organs is in abeyance. These circumstances account for the frequent cessation and reintroduction of its use. In modern times, the progress of orthopedia, gymnastics, and tenotomy, have increased the means at our command, by which we are enabled to promote the nutrition of the muscles and the restoration of their power.

We are less able to fulfil the other indication, of restoring the excitability of the central organs; the attempts we make with this view are very often futile. Our ignorance, and the incurability of the conditions which are the source of the interrupted excitability, are partly at fault, partly the absence of any remedies by which we are able to act directly upon these organs. We are only acquainted with two influences by which we can do it, viz., mental and reflex stimuli. The former are obtained by the agency of the will and the emotions, and not only by sudden and violent affections, as joy, fear, despair, but also by an enduring psychical tension, as may be induced by an enthusiastic reliance upon divine and human aid; the hopes formed are, however, frequently wrecked by the indolence or inconsistency of the patient. The reflex irritation is brought into play by the stimulation of centripetal sensory nerves; and in availing ourselves of this method it is by no means unimportant where and how the stimulus is applied. It is in reflex paralysis that the correct choice determines the success of the treatment; drastic purges are suited for the paralysis depending upon the intestinal canal; diuretics for the paralysis originating in the urinary organs. We shall advert to these points more fully in the descriptions of these diseases. But also in reference to other forms of paralysis the locality and the character of the reflex irritation are not unimportant. Certain parts of the surface, as, for instance, the soles of the feet, are endowed with a greater capability for reflex action than others. Irritant footbaths, containing nitromuriatic acid or liquor potassæ, are found to be effectual, when the perspiration of the feet has been suppressed, though the perspiration is not restored by the remedy.[1] The internal surface of the bladder, on account of its powerful reflex action, deserves more consideration than it has hitherto met with; and we should essay the use of injections with cold water in paraplegia, accompanied by paralysis of the sphincters. We may also avail ourselves of our knowledge of the definite relations existing between individual centripetal and motor tracts for the same purpose; thus the fifth pair may be made to act upon the facial or oculo-motor; the vagus upon the spinal nerves, which control the respiratory movements. Of the various kinds of reflex stimuli, the most powerful are brief applications of heat and cold; moxæ that burn off quickly; the approximation of hot vapours or hot metallic plates; sprinkling or affusion with cold water; frictions in a centripetal direction; electro-puncture, urtication, are also to be recommended, but we must carefully avoid prolonging the experiments until the reflex irritation is exhausted; they should always be repeated frequently at suitable intervals.

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[1] Loc. cit., pp. 9—11.

[2] See Froriep's book, as above quoted.

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[1] See Romberg's Klinische Ergebnisse, 1846, p. 69.

We possess two remedies which resemble the reflex stimuli in their mode of action, but in the manner in which we employ them, only act indirectly through the blood; they are the vegetal alkaloids, strychnine and brucine. They have both, but especially the former, been lauded and rejected in turns, which must be attributed to a want of discrimination of the paralytic affection, as well as to the haste and incompleteness of the observation. The following classification of the varieties of paralytic affections may be used as an indication and an encouragement for the employment of the remedy. It may be exhibited, 1, when the inexcitability of the motor nerves continues after the causes have been removed which have arrested the faculty of conduction; 2, in reflex paralysis; 3, in paralysis from commotion, whether of peripheral tracts or of central organs, and especially of the spinal cord. Strychnine is contraindicated when we find disorganisation coexisting with irritation, and in tabes dorsalis, in which case the progress of the disease is accelerated by its use. As regards the technical administration of the remedy, it is important, as in the use of many other drugs, not to exceed the point of saturation, while, on the other hand, its action on the system should be kept up for a considerable time. The paralysed parts are themselves the most sensitive re-agents, and are first and foremost attacked by more or less evanescent contractions and lancinating pains. The employment of strychnine ought not for this reason to be at once abandoned, but we should give smaller doses and at longer intervals; it is only when the symptoms attain a tetanic character, when anxiety and prostration supervene, that we should arrest the exhibition of strychnine, and give carbonate of ammonia, acetic ether, and the like. Among the various preparations the spirituous extract of nux vomica,[1] from $\frac{1}{3}$—1—2 grains, is preferable for internal administration, and the sulphate of strychnine for endermic application. According to Dr. Bardsley's accurate observations communicated in his work, 'Hospital Facts and Observations,'[1] the pure alkaloid given in doses of from $\frac{1}{8}$—$\frac{1}{2}$ a grain, two or three times a day, appears to be very efficacious. Brucine is less powerful in its action, and requires to be given in a four or six times larger dose.

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[1] [This preparation corresponds to the Extr. Nucis Vomicæ of the London Pharmacopœia. Both a watery and a spirituous extract are in use in Germany.]—Ed.

There is another vegetal alkaloid, veratrine, which has recently come into notice, and has hitherto been chiefly applied in neuralgic varieties of nervous affections; its value in paralysis deserves to be more accurately investigated. In a few cases in which I have employed an ointment containing from ten to fifteen grains of the alkaloid to half an ounce of lard, I found the benefit increased in proportion to the amount of pain associated with the diminution or loss of motility. Finally, there are substances which exert a specific stimulus upon individual motor nerves, such as cantharides upon the nerves of the bladder, secale cornutum upon the uterine nerves.

Among the normal vital stimuli which are capable of curing paralysis, warmth is the most powerful. More has been expected of the effect of animal warmth in the shape of animal baths and accubitus,[2] than has been warranted by experiment; telluric warmth, on the other hand, as afforded to us in thermal springs, frequently manifests its remedial power. The waters of Teplitz and Wiesbaden prove most effectual in rheumatic and arthritic paralysis, those of Aix-la-Chapelle and Nenndorf in metallic paralysis, of Ems in the hysterical form, the waters of Gastein and Wildbad in the paralysis induced by fatigue and exhaustion of the motor power, as occurs in precocious senility.[3]

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[1] London, 1830.

[2] [Animal baths, balnea animalia, are obtained by immersing the affected parts into the reeking bodies of recently-killed animals. Accubitus consists in placing a healthy vigorous individual, puris naturalibus, in bed with a patient; some of the older authors have recommended this procedure in old age, in place of the Medean system of rejuvenescence. No instance of its medicinal employment since the time of Sydenham has come to my knowledge.]—Ed.

[3] [The main constituents of these mineral waters are as follow:—

Teplitz—Carbonate and sulphate of soda, nitrogen, and carbonic acid gas; temperature of the different springs from 79°—121° Fahr.

The rather unscientific assumption of nervous debility in paralysis has caused the introduction of a farrago of tonic and stimulant remedies into the treatment of these diseases, the unsuccessful effect of which is likely at last to cause them to be abandoned. It is only in an anemic constitution, whether of a primary or secondary character, or if connected with a dyscrasia (as the cachetic paralysis of old people), that we can hope for any benefit to be obtained from the restoration of the blood. In such cases the natural chalybeates, as Pyrmont, Spaa, Driburg, are peculiarly appropriate; the testimony of Doctors Marcard, Brandis, and Brück, speaks strongly in favour of this fact.

In addition to this procedure, we have the choice of two means, by which we are able, in obstinate cases, to obtain a change; it is by inducing a reaction, or by translation. The former indication is fulfilled by using cold water in the form of affusion, the douche, the plunge bath, and in recent times by the methodical application of cold moisture; we possess too few well-observed facts as yet to justify any great hopes of the efficacy of the water cure in paralysis. The skin and the intestinal canal are best adapted for translation or counter-irritation. Issues have an ancient reputation, which they deserve most in diseases of the osseous and membranous envelopes, or in impetiginous complications or metastases. Derivation to the gastric tract of the vagus, by means of emetics, counteracts the paralytic affection of its respiratory distribution.

I may be allowed to close these introductory remarks with the caution not to subject paralytic patients suffering from

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WIESBADEN—Chloride of sodium, carbonate of iron, and carbonic acid; temperature from 118°—158° Fahr.

AIX-LA-CHAPELLE—Carbonate of soda, chloride of sodium, sulphuretted hydrogen, nitrogen, and carbonic acid gas; temperature from 115°—135° Fahr.

NENNDORF—Sulphate and carbonate of lime, sulphate of soda, and sulphuretted hydrogen; temperature 50°—59° Fahr.

EMS—Carbonated alkalis and earths, carbonic acid gas; temperature, 72°—122° Fahr.

WILDBAD and GASTEIN contain no appreciable amount of mineral constituents; their effects are attributed to their temperature, which is from 80°—110° Fahr.

For full information on the subject, see—Dr. Sutro, on the German Mineral Waters, London, 1851; and Dr. Sobernheim, Deutschland's Heilquellen, Berlin, 1836.]—ED.

maladies that we know to be incurable, such as tabes dorsalis or destruction of portions of nerves, to useless and painful attempts at treatment. It is in these cases that the man of science establishes his superiority over that herd of practitioners who now-a-days pounce upon every sick person as their legitimate prey.

FIRST ORDER.

PARALYSES DEPENDENT UPON A LOSS OF CONDUCTING POWER OF THE MOTOR NERVES AS CONDUCTORS.

CHAPTER XXXV.

PARALYSIS OF THE FACIAL NERVE.

HISTRIONIC PARALYSIS.

The characteristic features of this variety of paralysis, to which an historical interest attaches, as it served to lead Bell to the regeneration of the pathology of the nerves, on which account it still goes by the name of Bell's paralysis in England, is the arrest of the movements of those muscles which are supplied by the facial nerve; it affects a few or all the muscles of one or both sides of the face. The patient is unable to corrugate his forehead, the furrows on which disappear at once with the paralysis, so that the brow of an old man becomes as smooth as that of a child, and no more effectual cosmetic is to be found for elderly ladies. The eyebrow can neither be drawn up nor corrugated, and assumes a lower position; the lids cannot be closed, and are deprived of their blinking movement. The ala nasi is sunk, and is not expanded on deep inspiration, in blowing the nose, nor in smelling. The palsied cheek swells out in speaking and in other expiratory actions. Enunciation, especially of the labials, is impaired; attempts at spitting, blowing, or whistling, fail; the air escapes from the paralysed fissure of the lips, and the saliva and beverages taken leak out. In eating, the food is apt to accumulate between the inner surface of the cheek and the teeth, as the lips and the cheek refuse to assist in mastication.

Not less characteristic than the arrest of movement in the muscles supplied by the facial nerve in unilateral paralysis, is the overbalance acquired by the antagonising and symmetrical muscles of the healthy half of the face. The open state of the eye, in waking and sleeping, depends rather upon the increased activity of the levator palpebræ than upon the paralysis of the orbicularis. The upper eyelid is strongly drawn up, it shows a smaller edge than the healthy eye, which therefore appears larger than its fellow. This would not be the case in mere immobility of the orbicularis, of which we may easily convince ourselves in division of the levator palpebræ, as performed by Professor Dieffenbach, for the removal of the deformity. The contraction of the muscles of the healthy half of the face is chiefly at fault in causing the disfigurement, as it alters the median line, and draws the tip of the nose and mouth on one side. The distortion of the features which may be present in a marked or very trifling degree in unilateral paralysis, becomes more prominent in all histrionic or respiratory movements of the face, in speaking, laughing, crying, sneezing, blowing the nose, yawning, or in violent emotions.

The effect is different when both facial nerves are paralysed. In two cases that have recently come to my notice, the face presented no disfigurement beyond the eyes being distended; in one of the patients, however, a man aged 43, the smoothness of the forehead and the absence of every kind of furrow was remarkable. The absence of expression in speaking was yet more conspicuous in the beautiful countenance of a young lady. One of the patients was very sensitive on this point, and termed it his greatest misfortune that he was forced to be joyful or sad without making any demonstration of his feelings to his fellow creatures. In a girl of 16, in Dupuytren's[1] 'Clinique,' who was affected with bilateral paralysis, there was no distortion, but a pendulousness and entire absence of motion was perceptible in all the features. The eyelids only closed half, the lips stood apart, and played backwards and forwards from the impulse of respiration. The expressive countenance bore a serious character, which contrasted forcibly with the patient's frame of mind. She was heard to laugh aloud, but the laugh appeared to come from behind a mask.

The paralysis of the muscles is accompanied by some other phenomena. On account of the immobility of the lower eyelid the tears cannot be easily conducted to the inner angle of the eye; they accumulate and trickle down the cheeks, in consequence of which the corresponding nostril is dry. Owing to the absence of protection afforded by the movements of blinking and closing the eyelids, the eye is exposed to external influences, and is not unfrequently attacked with conjunctivitis. The respiratory effort is prevented by the immobility of the nares, which is essential to full gratification of the sense of smell; for this reason animals in whom the trunks of the facial nerves have been divided, are no longer able to follow scent or to prick up their ears to listen.

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[1] Bell; The Nervous System of the Human Body, p. 327, 3d edit.; Edin., 1838.

If the affection be limited to the facial nerve, the sensibility of the face is unimpaired; I have satisfied myself and others of this by an accurate examination of all cases of the kind that have presented themselves to me. When the paralysis has lasted for a considerable period, we find that the skin covering the muscles paralysed, especially of the cheek, becomes relaxed and flaccid. In paralysis of the palpebral twigs there is not unfrequently a procidentia and semi-ectropium of the lower eyelid.

The above description includes the prevailing features of histrionic facial paralysis; they are somewhat modified by the seat of the disease.

1. PARALYSIS OF THE PERIPHERAL PORTION OF THE FACIAL NERVE.—The physiological characteristic is the isolated non-conductibility on the same side as the exciting cause.

The diagnostic signs differ according to the seat in the different portions of the facial, that is whether the affection resides in the superficial branches, in the part passing through the temporal bone, or at the base of the brain.

a. The Paralysis caused by an affection of the superficial distribution of the Facial Nerve.—External injuries and surgical operations occasionally leave a paralysis limited to one or a few branches of the facial nerve. In a young man, in whom a large steatomatous tumour had been removed from the cheek, by which operation the labial and nasal twigs of the facial had been divided, I found the left upper lip, and the left ala nasi, paralysed. Bell,[1] in extirpating a tumour near the ear, divided the branch of the facial nerve which goes to the angle of the mouth; some time after, the patient, who was a coachman, came to Sir Charles to thank him for his cure, but at the same time complained that he was no longer able to whistle to his horses. Pressure of a permanent or temporary kind upon the facial nerve, deprives the facial nerve of its conducting power. Sir Benjamin Brodie[1] has met with a unilateral facial paralysis, resulting from a blow upon the cheek. Pressure of the forceps often induces a connate form of facial paralysis, which was first pointed out by Dr. Osiander,[2] and has been attributed by Dr. Landouzy[3] to compression of the facial nerve. The pressure of the forceps rarely affects the trunk of the nerve itself at its exit from the stylo-mastoid foramen, but as the blades are generally applied in the occipito-mental diameter, so that the posterior edge of the blade presses a few lines anteriorly to the auricula, on a level with the main branches of the facial, the nerves of the eyelids, the ala nasi, and of the lips, are liable to be affected. The paralysis may, however, be more limited if the pressure does not operate uniformly, and only involves a few filaments. Immediately after birth, at the first cry of the infant, the distortion of the features manifests itself, but there is no patency of the eyes. Sucking too is well performed if the nipple is normal.

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[1] The Nervous System, &c., 3d ed., 1836, p. 56.

Tumours and deep cicatrices give rise to permanent compression; it is generally by tumefied lymphatic glands, in the vicinity of the mastoid process, or at the lower edge of the inferior maxilla, that pressure is exerted upon the facial as it issues from the stylo-mastoid foramen, and paralyses the whole of its facial distributions. Ragged cicatrices of scrofulous ulcers occupying this part operate similarly. Degenerations of the parotid[4] and morbid growths, less frequently induce the affection. The ramifications of the facial are most frequently paralysed by the influence of cold or draughts, though they do not always suffer in their entire extent, but sometimes are only affected in groups, so that according to the law of isolated conduction, only one group of muscles, or an individual muscle, may become paralytic. The nerves of the orbicularis palpebrarum are especially liable to lose their conducting power in this way, and we then have to deal with lagophthalmus paralyticus. In the above-mentioned case I found that, owing to a rheumatic influence, the action of a cold current upon the heated face, first induced paralysis in the right, and two days subsequently, in the left side of the face.

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[1] Abercrombie; Pathological and Practical Researches, &c., 3d ed., p. 280.

[2] Handbuch der Entbindungskunst; Tübingen, 1825, vol. ii, part 2.

[3] Essai sur l'Hémiplégie faciale chez les Enfans nouveaux-nés; Paris, 1839.

[4] See an accurate observation by Billard, in—Descot's Dissertation sur les Affections locales des Nerfs; Paris, 1825, p. 318.

b. The Paralysis caused by an Affection of the Facial in its passage through the Temporal Bone.—In injuries to the head fissures and fractures may occur in the os petrosum, in which case the histrionic paralysis of the corresponding side affords a diagnostic sign of the seat of the injury. Sir Charles Bell[1] relates a case of this kind, in which a pistol shot through the ear had broken up the petrous bone, and torn the facial nerve; and another in which a man, after a fall upon his head, survived for a week in a state of sopor, the left half of the face being paralysed. A fracture was found to pass transversely through the base of the brain and the left petrous bone, and it had torn the facial end, the point of its entrance into the internal meatus. Tuberculosis and consequent necrosis of the temporal bone, are frequent causes of the affection.[2] My opinion was taken, in 1835, for a girl of two years, in an extreme state of emaciation from tabes mesenterica, and affected with otorrhœa of the left ear. When the abdomen was pressed the girl began to cry, but only the left side of the face showed any play of the features, the right remained motionless. The corrugator supercilii did not move on this side, while the right corresponding muscle contracted the brow. The left eyelids stood open, the eye was turned up, whereas the right closed during crying, and as the mother assured me, when the question was put, during sleep also. The left ala nasi was collapsed, the tip of the nose and the mouth being drawn over to the right side. When in a state of repose there was no distortion of the features beyond a wider distension of the eyelids, causing the right eye to appear larger than the left, and a slight inclination of the tip of the nose to the right side. A few days after, the child died. The cranial cavity was examined by Dr. Henle, the prosector to the university. On the arachnoid of the surface of the two hemispheres of the cerebellum, there was a large number of small granulations consisting of what resembled inspissated pus. In the cortical tissue of that portion of the middle lobe which rests upon the left petrous bone, three deposits of tubercle were found. After removing the dura mater, the pars petrosa appeared of a brownish hue, and looked worm eaten; it was dissected out and carefully examined. It was thoroughly carious. No trace of the malleus was to be found, nor was there a membrana tympani, so that the pus escaped freely through the cavity of the tympanum and the external ear. The facial nerve, at the part termed the genu, was healthy, but within the Fallopian canal a part was disorganised by a softening process. In another case, examined by Froriep, not only the cells of the mastoid process, but even the Fallopian canal itself, were filled with tubercular matter, so that the facial nerve was compressed as far as its point of exit. The os petrosum was necrosed, and the membrane of the tympanum and the ossicula auditus, with the exception of the stapes, were destroyed. Osseous tubercles were also found in the upper and lower extremities.[1] The facial is occasionally affected by a tumour of the dura mater, or the bone itself, at its entrance into the foramen auditorium of the petrous bone, a few instances of which have been communicated by Gregory.[2] In a man, 40 years of age, on the cessation of an otorrhœa from the right ear, which had troubled him from his infancy, deafness and paralysis of the muscles supplied by the right facial nerve, ensued. Death resulted from a disease of the pancreas; a tumour of the size of a walnut was then found imbedded in the pars petrosa of the right temporal bone, of cartilaginous hardness and pearly lustre, projecting above the foramen auditorium, and firmly compressing the facial and auditory nerve.

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[1] Loc. cit., pp. 253 and 282.

[2] See—Romberg; über Lähmung des Antlitznerven durch Krankheit des Felsenbeins, in Casper's Wochenschrift für die gesammte Heilkunde. 1835, p. 601.

The second case, which is particularly interesting, as the tumour protruded from the cranial cavity, occurred in a female of 35, who was affected with paralysis of the right side of the face, and deafness of the corresponding ear. For a time there had been a discharge from this ear, during which the deafness was diminished; at the same time she complained of cephalalgia of the right side, and frequent painful vomiting. A deep-seated tumour of a considerable size was discovered between the right angle of the jaw and the mastoid process. The external and internal administration of iodine reduced the tumour, but the movements of the features continued impaired. Half a year later she was admitted into the hospital; at this time the symptoms were violent headache, tinnitus aurium, intolerance of light, contraction of the pupils, strabismus, and vomiting. The tumour was enlarged, the paralysis and deafness unaltered, articulation was indistinct. Erysipelas extended from the head, upon which a blister had been applied, over a large portion of the body. The patient died of great exhaustion and emaciation, without any preceding sopor or convulsions. The external, firm, scirrhous mass formed a portion of a broad, irregular tumour, or rather a chain of tumours which were closely attached to one another; they had produced absorption of the cuneiform process, and of the right condyle of the occipital bone, as well as necrosis of a large part of the right temporal bone, into which a portion of the tumour was deeply and firmly imbedded. The tumour occupied a considerable space in the fossa cerebelli, so that the right hemisphere of the cerebellum, the pons Varolii and the medulla oblongata were compressed and pushed over to the left side. Both restiform processes appeared flattened; the right facial and acoustic nerves were softened and compressed by a portion of the tumour, above which the fibres of the glosso-pharyngeus and hypoglossus were spread out; the abducens was also compressed. A small firm tumour of the size of an olive, with a portion of the larger mass, to which it was loosely attached, had penetrated deeply into the substance of the right hemisphere of the cerebellum.

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[1] See Massalien; Dissert. Inaugur. de Nervo faciali; Berolin. 1836.

[2] Edinburgh Medical and Surgical Journal, 1834, vol. xlii, p. 272.

The diagnosis of the disease affecting the facial in its passage through the bone, depends upon—1, the phenomena which are induced by the morbid process in the bone; otorrhœa, with rejection of necrosed portions of bone, of the ossicula auditus, &c.; 2, upon the implication of the auditory nerve, when the cause resides at the point where the facial enters into the petrous bone, in which case deafness commonly accompanies the paralysis; 3, upon peculiarities in the paralytic phenomena. On account of all the primary fasciculi of the facial being involved in the trunk, not only the branches distributed to the face are deprived of their conducting power, but also some nerves about whose physiological distinction we are yet in the dark. They are the chorda tympani and the nervus petrosus superior. Arnold[1] was the first to demonstrate that a twig of the chorda tympani was a motor root of the ganglion sub-maxillare sive linguale, and has since[2] drawn attention to the influence exerted upon the expulsion of the saliva from the ductus Whartonianus in a case of paralysis of the facial, in which the discharge of the saliva was diminished on the affected side. In my patient whose case has been related above, the paralysis of both facial nerves resulted from an external injury to the head; the temporal bones had suffered especially, by being compressed between two beams, as proved both by deafness supervening with the paralysis, which afterwards disappeared, and by hæmorrhage from the ears. There was a very unpleasant sense of dryness in the cavity of the mouth, which the patient sought to remove by frequent rinsing and gargling. The lower surface of the tongue and the cavity of the lower jaw was drier than usual.

The facial nerve also supplies the salivary duct;[3] but when the disease resides in the facial ramifications, it is difficult to determine whether a similar arrest takes place in the evacuant movements of the ductus Stenonianus, as the duct of the submaxillary gland continues to act. The patients suffering under this malady that I have attended, and even the female labouring under paralysis of both halves of the face, did not complain of dryness in the corresponding part of the oral cavity. There is another phenomenon frequently observed in paralysis of the facial nerve within its osseous canal, which we must consider at this place; it is the alteration and diminution of taste on the corresponding side of the tongue, without any implication of the sensibility or motility of the tongue. Professor Roux was himself affected with facial paralysis, and perceived a metallic taste in the right half of the tongue as a precursor of and an accompanying symptom of the paralysis.[1] Montault[2] quotes a few more instances. Recently Dr. Bernard[3] has again directed attention to the subject, and has also examined the subject anatomically and physiologically. In one case paralysis of the left half of the face was associated with deafness, and an injury to the temporal bone had preceded for several years. Sensibility had been maintained entire, even in the tongue, which was perfectly moveable in every direction. At the anterior portion of the left half of the tongue the sense of taste, especially for some things, was diminished; powdered citric acid was tasted much slower and weaker at this part than on the right side. The author considers the chorda tympani to be a motor nerve distributed to the mucous membrane of the tongue, for the purpose of causing the erection of the nervous papillæ, and rendering them more susceptible of sapid articles, a view that is not likely to meet with many supporters. The phenomenon itself requires further confirmation.[4] Bidder[5] was the first to offer a physiological explanation of the functions of the nervus petrosus superficialis major; he considers it as a motor nerve passing from the facial to the sphenopalatine ganglion, destined to move the velum palati. The unilateral paralysis of the velum palati seems to depend upon the loss of conducting power in these nerve fibres, which gives the uvula a slanting direction, causing its point to be directed to the paralysed side; it resumes its normal position after a cure has been affected. In four patients affected with palsy of the facial I have noticed the hemiplegic condition of the velum palati. One was an otherwise healthy man, 38 years of age, who having caught cold in washing his neck and face, was seized with paralysis of the left facial in its entire extent. At the same time he complained of a dull pain in the depth of the left ear, with difficulty of hearing and a sense of dryness in the left side of the mouth. The uvula had a slanting direction, was arched, and the tip pointed to the left. It was evident that the seat of the disease lay in the petrous bone. Contrary to my expectations, he rapidly recovered in a fortnight, after the local abstraction of blood behind the left ear, inunctions of tartrate of antimony ointment, and the internal exhibition of a solution of sulphate of magnesia, with tincture of the seeds of colchicum. The facial muscles resumed their straight position somewhat later than the uvula.

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[1] Der Kopftheil des Vegetativen Nervensystems beim Menschen; Heidelberg, 1831, p. 119.

[2] Untersuchungen im Gebiete der Anatomie und Physiologie, 1 Bändchen; Zurich, 1838, p. 210.

[3] Longet; Anatomie et Physiologie du Système Nerveux; Paris, 1842, vol. ii, p. 456.

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[1] Descot; Dissertation sur les Affections locales des Nerfs; Paris, 1825, p. 331.

[2] Dissertation sur l'Hémiplégie Faciale; Paris, 1831, p. 15.

[3] Recherches Anatomiques et Physiologiques, &c.—in Journal de l'Anatomie et de la Pathologie du Système Nerveux; Paris, 1843, vol. i, p. 408.

[4] In an article by Mr. Wilde, of Dublin, on the Cause and Treatment of Otorrhœa, I find it remarked, that the application of lunar caustic to the membrana tympani, is often tasted. A young lady in whom small excrescences grew through the perforated tympanum, related that she distinctly felt the effect of the caustic running down the margin of the tongue, but never reaching the tip. (From the Journal für Kinderkrankheiten von Behrend und Hildebrand, vol. iii, p. 193.)

Neurologische Beobachtungen, 1836, p. 40.

The other patient presented a complete paralysis of the left facial, dependent upon a disease at the base of the brain, and accompanied by the loss of conduction in the adjoining nerves, the fifth, the abducens, the acoustic, and the vagus; the muscles of mastication had, however, preserved their integrity. In this case the velum palati also had an abnormal position, the uvula slanted, and was arched towards the left side. In the third case, that of a scrofulous girl of 13, who had become affected with paralysis of the right facial nerve and deafness, subsequent upon otorrhœa, there was also hemiplegia of the velum, and the uvula was arched and its tip turned to the right side. The fourth case occurred in a girl of 8 years, who from her infancy has suffered from paralysis of the left facial in its entire extent. The cicatrices of deep cuts near the stylomastoid foramen, might easily induce the suspicion that they were the cause of the paralytic affection; but the marked curving of the uvula to the left side, showed that the seat of the disease must reside within the petrous portion; and this view was fully confirmed by the information communicated by the mother, that in the seventh month the child had suffered from violent otorrhœa of the left ear, during which small peculiarly-formed portions of bone had been discharged. When this child was brought to the Clinique, the mouth was found to be drawn to the left side, a symptom at variance with the other evidences of paralysis of the left facial nerve. The cause of this, however, was mechanical; a scrofulous swelling, which subsequently formed an abscess in the right cheek, had forced the mouth over to the left side. These cases are all of the more importance, as the action of the motor portion of the fifth nerve, from which the muscular nerves of the velum are derived, was unimpaired.

When the disease resides in the superficial distribution of the facial nerve, the velum is not affected, a fact of which I have convinced myself by repeated observation. We do not know what influence is exerted by paralysis of the stapedius muscle, which is supplied by a twig of the facial nerve.

c. The paralysing agent is seated at the cerebral origin of the facial nerve. Exudation and tumours in the vicinity of the pons Varolii are the common cause of this affection; the tumour occasionally proceeds from the dura mater;[1] the histrionic paralysis affecting the entire range of the facial is in these cases accompanied by a successive implication of the adjoining nerves, the acoustic, the abducens, the trigeminus (deafness, strabismus introrsum, anæsthesia,) depending upon the extension of the tumour. We have already given an instance at page 272, and we shall have occasion to mention another as we proceed.

2. PARALYSIS OF THE CENTRAL TRACT OF THE FACIAL.

The physiological characteristic of the affection is, that the conduction takes place in a crucial direction; the diagnostic sign is, that other sensory and motor nerves of the face and trunk participate in the loss of the power of conduction. A peculiar feature in the centric paralysis of the facial nerve in disorganisation of the brain is, that with few exceptions the entire distribution is not affected, but those fibres only are implicated which supply the muscles of the alæ nasi and the upper lip, and are the agents of the respiratory functions of the facial, which for this reason was termed by Bell the facial nerve of respiration. (Compare the post-mortem examination of Dupuytren's brain, as given in the chapter on cerebral paralysis.) The snuffling respiration and the blowing-up of the lip in the breathing of apoplectic subjects, is due to this cause. In the description of the death-struggle given in the prognostics of Hippocrates, the *ρῖς ὀξε͂ια*, the pointed, sunken nose, forms a main feature.

In addition to the seat of the disease, the relation of the facial nerve, as one of motion, to reflex and cerebral stimulation, deserves our consideration on account of the modifications of the phenomena it gives rise to. Bell,[2] whose work is no less rich in promising germs than in mature fruit, observes: "As you find the portio dura in possession of distinct properties, all of them related to respiration, breathing, speech, and expression, you will not be surprised that these functions should occasionally be differently affected; as, for example, a man will continue to possess the power over the nerve, as the nerve of speech, and yet he will be incapable of expressing the usual signs in laughter or in crying. In short you find that your patient sometimes exhibits paralysis of the side of the face only when he smiles or laughs, at other times it is not observable. We really have no reason to conclude that the one property of a nerve requires a finer organisation than another. I should rather suppose that this power of expression is constituted with a finer relation to the condition of the mind and of the body; and therefore, we may suppose is more easily affected by slighter derangements."

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[1] Abercrombie; loc. cit., p. 422.

[2] The Nervous System, &c., p. 256.

One of the most instructive cases by which the difference of the stimulus of the will from the reflex impulse or the influence of emotion, is exhibited, has been observed by my friend Dr. Magnus, and has been elegantly described by him in Müller's Archiv.[1] I have myself often examined the patient, and finally she became a patient of mine in the cholera hospital, where she died. The following are the main points of the case:—The subject was a widow, aged 50, who had already passed through two apoplectic attacks, causing the loss of speech and paralysis of the left side; the first had supervened during a confinement after violent vexation and the cessation of the lochia, the second in consequence of her menses being suppressed by a cold. After the latter the paralysis of the extremities was removed, but speech was not restored, as had been the case after the first seizure. The face of the patient was perfectly smooth, without either a furrow or an expression. All the muscles of the face were deprived of voluntary movement. She was neither able to contract her forehead nor her eyebrows, to raise the nostrils nor to move her cheek and chin. She was incapable of closing the eyelids voluntarily. When required to do it she used her finger, or looked on the ground, by which the eyeball was directed downwards, the levator tarsi relaxed in its contraction, and the upper eyelid also moved downwards. On the other hand, the eyelids closed perfectly as soon as a sudden movement was made towards the eye of the patient, if she was directed to look suddenly into a bright light, or when she sneezed. During sleep the eyes were also perfectly closed. The patient was neither able to raise nor close her lips, so that the mouth was constantly opened slightly and the saliva ran out, rendering it necessary for the patient to be constantly wiping her lips. The lower jaw was moveable, the patient was able to open her mouth and chew; but even these movements were not quite of a healthy character, for she was unable to open the mouth wide, and she was equally incapable of performing rapid movements of the lower jaw upon the upper jaw, so as to strike the two rows of teeth against one another with sufficient force. The tongue did not in the least obey the will; the patient was neither able to protrude it between the teeth, nor to move it backwards or to the sides; it lay in the mouth like a wedge, and rendered voluntary deglutition and mastication almost impossible; for when the patient had introduced food between the teeth, she was obliged, as the tongue was immoveable, to push it from side to side with the finger, and also when she chewed to push the morsel over the tongue into the pharynx; as soon as this was done, all the movements of deglutition ensued, with all those movements of the tongue which are generally under the control of the will in health. The same took place in drinking; if deglutition was to be obtained, the head required to be bent backwards, and the liquid had to be poured down, or to be introduced beyond the velum by means of a spoon, otherwise it was apt to run out of the mouth again. From time to time, even without taking food, the secreted saliva was spontaneously swallowed, as it accumulated to so great an amount as to fill the entire cavity of the mouth, and then, like a chewed morsel, induce deglutition. The sense of taste, as well as the tactile sensation, were unimpaired both in the tongue and throughout the surface of the face. Speech was impeded, but there was not complete aphonia, for the patient was able to utter an inarticulate sound, but it was out of her power to modulate its pitch. The sound was not a distinct vowel, but something like *ang* or *ong*, for even when the mouth was wide open she was unable to say *a* distinctly, much less to articulate any other vowel. There is one other emotional impulse and expression of the features to be mentioned, viz. that of laughing, whether excited by reading or conversation. The patient smiled and laughed, passing through all the shades of the movement without any difficulty, and at the same time the lips, cheeks, and nostrils went through the same movements which a healthy person can perform, but over which our patient had no control. They were as little induced by any external stimulus as pricking or pinching the cheek. When she laughed she was also able to produce other sounds besides those mentioned. These sounds were also inarticulate, but still they varied in their elevation according to the character of the emotion that caused the laugh, a circumstance not otherwise observed. But it became evident how little these sounds were under the voluntary control of the patient when she laughed violently; she then uttered a peculiar, grunting, animal sound, of which she was in a measure ashamed, and which she would willingly have suppressed; she therefore tried to shorten it as much as possible; however, the sound continued even after the movements of laughter had ceased, at a time when in a healthy individual no further sound would have been emitted. During the epidemy of 1837, this patient was attacked with cholera asphyctica, and she died within thirty-six hours. The post-mortem examination was made by Froriep; and at the external edge of the right hemisphere of the cerebrum, where the anterior lobe adjoins the middle one, an hæmorrhagic cyst was found by which two gyri were destroyed. Its cavity was about equal to a small walnut, and the inner surface was invested with a yellowish membrane. The tissue in the vicinity of the cyst was rather denser than the rest of the cerebral matter, and showed some erosions. The septum pellucidum appeared very much thickened. The walls of the left ventricle of the heart were hypertrophied.

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[1] Jahrgang, 1837, p. 258.

The converse of the case just detailed is related by A. Stromeyer;[1] here the voluntary muscles supplied by the facial nerve continued under the control of the will, while the respiratory and emotional influences had ceased. It occurred in a girl of 12 years, in whom the right side of the face continued expressionless in emotions, and showed no increased action in accelerated respiration after running, going up stairs, &c. Nevertheless, the child was as able to controul the muscles on this side as those on the left; she could move the angle of the mouth, dilate her nostrils, wrinkle her forehead, and contract her eyebrows at will. There was no marked change in the sensation of the right side. The movements of mastication were undisturbed at either side. When the child was regarded full in the face, while in a state of repose, the mouth was found to slant, as in the usual instances of sudden peripheral paralysis of the facial nerve; but as soon as the features were altered by emotions or by talking, the unequal action of the two sides of the face became manifest. Besides, when looking straight at the patient, it was easy to see a certain emaciation of the affected side, which was particularly conspicuous at the chin, where the prominence of the quadratus menti was absent on the right, but was well marked on the left side. The child was delicate, and the malady was developed gradually. Besides there was a deviation of the vertebral column between the scapulæ, of about one third of an inch from the straight line to the left, and the right half of the thorax appeared sunk to the same extent. On compressing the epigastric region, it appeared that the right half of the thorax scarcely took any part in the forcible thoracic respiration which was induced by the pushing back of the diaphragm. When this kind of examination was made, the apathy of the one half of the face was particularly manifested at the nares; whilst the right one remained immoveable, the left one expanded fully at every act of inspiration.

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[1] Casper's Wochenschrift für die gesammte Heilkunde, 1837, p. 33.

We have lastly to allude to the immobility of the muscles supplied by the facial in anæsthesia of the fifth pair. We have already mentioned, that division of the fifth pair in animals gives rise to an arrest in the movements of the face, especially in reflex action. In three cases of anæsthesia of the fifth nerve of the left side, two of which I have myself observed, not only the reflected movements were arrested, but the voluntary ones were much impeded and in part prevented. One of the patients was unable to draw the mouth with sufficient force to the left side, and the other was unable to move the diseased side of the face with the same force and rapidity as the healthy side.

There is no period of life which may not be attacked with histrionic facial paralysis; even the unborn infant, as we have already seen, is liable to the affection; the period of infancy on the whole predisposes more to paralysis from disease of the bones or glands; advanced life, after the fiftieth year, to centric paralysis. Among the dyscrasiæ, scrofula is a more frequent predisposing cause than syphilis and carcinoma; they act by involving the parts adjoining the nerves, the cellular tissue, the membranes and bones. Dr. Landouzy[1] has described a remarkable instance in which carcinoma gave rise to the complaint. The patient, a female, suffered from anæsthesia of the fifth nerve, and paralysis of the facial of the left side; a scirrhous tumour extended in the left half of the face from the upper part of the ear to below the angle of the jaw; death ensued from pneumonia. At the post-mortem a scirrhous tumour was found at the base of the brain, pressing upon the ganglion Casseri and the divisions of the fifth nerve; there were also numerous encephaloid growths in the liver and kidneys. One of the most frequent exciting causes is rheumatism, or cold taken while the surface of the face is hot or perspiring. Joseph Frank[2] states, that there were seven among his patients who were suddenly attacked with this paralytic affection on getting up in the morning and putting their head out of window and drawing back because they found it very cold. One of my patients, on waking up during the night from a heavy dream, exposed her face, which was bathed in perspiration, to a current of air, and on the following morning found that her features were distorted. Shaw[3] states that during the prevalence of the cold winds in East India the disease occurs very frequently. Nothing is more likely to produce the affection than a current of air impinging upon the part while the patient is asleep, *e. g.* from sleeping with an open window. It is very common for pain and tumefaction, accompanied by febricitations, to occur in the affected side of the face, after the patient has caught cold; these symptoms disappear after a few days, and the paralysis remains. Among the centric causes, hæmorrhage and softening of the brain are the most common. Violent mental emotions have in some instances preceded the occurrence of the paralysis.[1]

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[1] Bulletin de la Societé Anatomique, 1839, No. 11.

[2] Prax. Medic. Univer. Præcepta, vol. i, 2d ed.; Lipsiæ, 1841, p. 555.

[3] Medico-Chir. Transactions, vol. xii, part 1, p. 128.

Histrionic paralysis of the face is rarely of brief duration; I have found it shortest in the rheumatic variety; but even in this case, and in favorable circumstances, I have rarely seen it yield in less than six weeks; once I found a cure ensue in eight, another time in fourteen days. Montault[2] quotes a case from Roi, of the disease running a periodic course in a woman, who only presented regular features during the full moon, but while the moon was in the wane, was disfigured by paralysis; but it is too incomplete to bear rigid criticism.

The diagnosis of the peripheral or centric origin of the disease is of extreme importance in reference to prognosis and treatment. It not rarely happens that the practitioner mistakes peripheral paralysis for a centric affection, and at once has recourse to the lancet or leeches, and neither allows himself nor the patient rest till he yields to the innocent and pleasing conviction that he has removed a great peril. By attending carefully to the law of isolated conduction, and to the irradiation belonging to the central apparatus, we shall avoid such errors. On the other hand, we must carefully avoid looking upon the affection when residing in the peripheral distribution of the nerve as always more favorable and less dangerous in a prognostic point of view. When the facial nerve is affected in its passage through the bone, there is not only a prospect of the disease proving incurable, but life itself is often perilled by the brain becoming implicated in the adjoining disorganisation, while the cure of centric paralysis is rendered possible by the apoplectic effusion being reabsorbed.

We possess no trustworthy data, as yet, to prove the spontaneous cure of histrionic paralysis following division and injury of the facial nerve by wounds and operations. Not only is the anatomical evidence wanting, which experiments upon animals have afforded with regard to other nerves of motion and sensation, but the proofs with reference to its physiological functions are also contradictory. Shaw[3] found the motor influence restored in two months in a monkey and a dog in which he divided the facial, while in another dog the paralysis persisted after four months. Magendie[1] found no trace of movement after ten weeks, and is of opinion that in the first case Shaw had not completely divided the nerve. In the instance above related I myself found the nasal and labial twigs paralysed a year and a half after the operation. On the other hand, in a boy of nine years, who had been attacked by murderers, and had received a penetrating stab with a knife in the vicinity of the stylo-mastoid foramen, I found that the paralysis of the labial and nasal branches of the facial disappeared after two months. In other varieties of facial paralysis, especially of rheumatic origin, in which the connection of the nerve with the central organ is maintained, I have seen the motor principle restored without any medical interference. I have convinced myself of this in several patients, who set aside all remedies, and after a quarter or half a year were entirely free of their paralysis. In one of my patients, a boy of eight years, otorrhœa and deafness of the left ear, with paralysis of the left side of the face, supervened upon scarlet fever. The most various remedies proving unavailing, his malady was left to take its own course. The otorrhœa has ceased, the paralysis has almost left him after six months, and only the deafness remains. The facial paralysis of new-born infants, that is caused by pressure of the forceps, gets well spontaneously, sometimes after a few hours or days, and, rarely, after the lapse of months. When recovery ensues it is remarkable that the conducting power is not restored in all branches of the facial at the same time, but returns successively in its different parts; thus the mouth may have resumed its straight position, while the eyelids are yet dilated, or the reverse; this must also be looked upon as a proof of the law of isolated conduction. There is another phenomenon which has not hitherto been attended to, and which is perceptible after the cure of the paralysis. It is that the eye of the paralysed side becomes smaller; I have observed it in several of my patients, and should explain it by the orbicularis overbalancing the levator tarsi which has become relaxed subsequent to its previously increased tension.

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[1] Joseph Frank, loc. cit., p. 556.

[2] Dissert. sur l'Hémiplégie faciale; Paris, 1831, p. 18.

[3] Loc. cit., p. 139.

The only *prophylactic* measures that we can adopt are those suggested in surgical operations by Dieffenbach, namely, of making the incision along the mesial line of the face and turning back the skin in order to avoid injuring the facial nerve.

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[1] Journal de Physiol. Experiment., vol. i, p. 121; vol. ii, p. 82.

In selecting our *treatment* we have first to attend to the cause of the complaint. When it is to be referred to rheumatic affection, emetics, the tincture and wine of colchicum, and, above all, blisters are to be recommended, the latter should be applied between the angle of the jaw and the mastoid process, and suppuration be maintained for a considerable time. In plethoric individuals, and if there be pain, especially in the ear, the local abstraction of blood by cupping and leeches to the mastoid process or at the back of the neck is advisable. When glandular swellings or indurations arrest the conducting power of the facial nerve, we must attend to the treatment of any cachectic conditions that may be present, whether of a scrofulous or other character, and we must also employ discutient remedies locally, such as mercurials, iodine ointment, or the combination of both in the shape of the biniodide of mercury. When there is any dyscrasic swelling of the bones, whether hyperostosis or exostosis, there is room for hope, even if the petrous bone or the base of the cranium be the seat of the disease, provided the nerve is not disorganised. Thus in the case cited from Dupuytren, of bilateral facial paralysis, there was a syphilitic predisposition, and the patient was restored by corrosive sublimate, sarsaparilla and blisters. In inveterate cases we must have recourse to the inunction and starvation cure.[1] (Hunger- and Schmier-Cur.) When there is a deposit of tubercular matter in the bones, accompanied by otorrhœa, oleum jecoris, and especially iodide of iron, are to be recommended, as well as the employment of salt baths. We shall have occasion to revert to the subject of central paralysis at another portion of the work.

If after we have exhausted our attempts to remove the cause, the paralysis continues, as is only too often the case, we are justified in availing ourselves of those remedies which exert an influence upon the motor power of the nerves. Among these we have to enumerate nux vomica; its alkaloids (the sulphate or acetate of strychnine) applied endermically to the amount of $\frac{1}{4}$—$\frac{1}{3}$ of a grain twice a day to the raw surface of a blister; frictions in a centrifugal direction, by themselves or combined with volatile substances, such as the balsamum vitæ Hoffmanni,[1] unguentum nervinum, spirits of ammonia, &c.; the cold and warm douche, vapours; moxæ; the mineral waters of Töplitz and Gastein; galvano-puncture; and electro-magnetising; the latter I have found effectual in a case that fell under my notice, in which the disease had lasted nine years, and the remedy was persevered in for thirty-three successive weeks.

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[1] [For the details of the systematic procedure by inunction and starvation, we must refer to the works of Rust, Velpeau, Cullerier, and others; the principle followed out is the introduction of a maximum of mercury by the skin, and of a minimum of food by the mouth; it is mainly in favour as a remedy for inveterate syphilis, though Velpeau also employs it in peritonitis and phlebitis uterina.]—Ed.

In paralysis of the face of long standing, and accompanied by great distortion of the face, Dieffenbach[2] has advised a surgical procedure, which though not likely to be generally adopted, has the merit of originality. As in paralytic vagus, the antagonistic muscles of the healthy side of the face contract permanently and rigidly at the expense of the paralysed muscles; and it was to be expected that here also the division of the healthy muscles, which produces a considerable diminution of the contractility, would, in a measure, restore the equilibrium. The immediate result of the operation was indeed surprising; the patients were able, after the division of the levator palpebræ superioris, to close the eye; and after the division of the orbicularis oris of the healthy side, the distortion of the face was relieved, but the good effect was not permanent in all.

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[1] [Bals. Vitæ Hoffm., see note, Vol. I, p. 106. Unguentum nervinum, sive Ung. Rorismarini compositum, contains rosemary, marjoram, rue, laurel, and bertram root, which are boiled down with lard, to which oil of rosemary and elder is added subsequently.]—Ed.

[2] Medicinische Zeitung des Vereins für Heilkunde, 1841, No. 37.

CHAPTER XXXVI.

PARALYSIS OF THE LESSER DIVISION OF THE FIFTH NERVE.

PARALYSIS OF THE MUSCLES OF MASTICATION.

Sir Charles Bell was the first to establish the motor functions of the lesser division of the fifth nerve, which already Vesalius, and subsequently Palletta, had recognised as a peculiar nerve, distinct from the rest of the trigeminus. We owe to him the discovery of the paralysis of the muscles of mastication, which had previously not been suspected, whilst the phenomena of facial paralysis were known to older observers.[1]

The pathognomonic character of this variety of paralysis is arrest of the movements of mastication in one or both sides of the face; the latter, however, occurs very rarely. The muscles that raise the jaw, draw it aside or downwards, singly or together refuse to do their duty. The mere appearance of the affected side is sufficient to show the nature of the malady, which is still more distinctly manifested by the touch. If the patient is made to masticate, and the physician lays his fingers on the temporal and masseter muscles, a distinct contraction and hardness is felt on one side, and an inactive and relaxed condition on the other. The patient is conscious of the obstacle; he does not chew with the diseased side, or rolls the food over to the healthy side with his tongue. During the process the jaw and the angle of the mouth assume a more or less oblique position; this is rarely observed while the parts are in a state of repose. I have not hitherto met with a case in which there was a preponderating action of the muscles of mastication of the healthy side, such as we see in histrionic paralysis of the facial. Nor have I discovered any alteration in the velum palati, although the tensor palati is supplied by a branch of the internal pterygoid. It has not as yet been determined how and whether the tensor tympani, which is supplied by a branch of the internal pterygoid nerve, that passes through the otic ganglion, is implicated in the paralysis. One of my patients is affected with difficulty of hearing on the diseased side; although Savarts' and Müller's[1] researches show that tension of the tympanum deadens sound.

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[1] Forestus—Opera Omnia, vol. i, lib. x, p. 587.

When the paralysis is persistent the muscles of mastication become paralysed; in a case recorded by Bell the left masseter was so reduced and flabby that the bone appeared to be directly under the skin.

The seat of the disease is either the peripheral or the central portion of the fifth nerve; the observations of the former that have hitherto occurred have shown the cause residing at the base of the brain or cranium, as in my own cases and those given by Bell. There generally was a tumour of the dura mater, or the bone, or of the ganglion of Casser itself, compressing the nerve. On account of the close proximity of the sensory portion of the fifth nerve, there was at the same time anæsthesia of the corresponding side of the face and its cavities. This is the case with the female, whose case I have already related, and who is yet vividly before my mind. She had formerly often suffered from intermittent fevers, headache, and vertigo. Eight years ago, after a severe cold in the feet, the pain rose, especially in the left temple, to an extreme pitch; trismus supervened, and lasted six weeks, accompanied by violent pains of the left side of the face. When these remitted, paralysis of the muscles of mastication and anæsthesia of the three divisions of the fifth on the left side, remained, the symptoms of which have been elsewhere described. In addition to anæsthesia we may find other nerves implicated, which must depend upon the position and extent of the tumour.

The centric origin of the paralysis of mastication is proved by the coincident affection of other nerves of the face, the tongue, and the extremities. The centric affection of the muscles of mastication is generally confined to one side, according to the law of decussation. During the death struggle it extends to both sides; this gives rise to the falling of the lower jaw, as in animals whose fifth nerve has been divided.

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[1] Müller's Elements, &c., Dr. Baly's transl., vol. ii, 1262.

The greater distance of the motor portion of the fifth nerve from the surface of the face, affords it more protection from all those influences which often and easily affect the facial nerve. Morbid changes in the sphenoid bone, through which the masticatory nerve passes, are less frequent than disease of the temporal bone. This species of paralysis is induced by tumours, morbid growths and exudations at the base of the cranium and brain. The centric is more common than the peripheral form; and this serves to distinguish masticatory from histrionic paralysis; as a rule the fibres of the trigeminus, both those possessing motor, and those with sensory functions, are more liable to be involved in affections of the central organs than those of the facial and other nerves. This accounts for the frequency of sympathetic action, of neuralgic and convulsive attacks, in the range of this powerful nerve. Thus I have observed[1] one-sided paralysis of the muscles of mastication, resulting from hæmorrhage of the brain, associated with anæsthesia of the third branch of the fifth pair.

The prognosis is, on the whole, less favorable than in histrionic paralysis, on account of the seat of the disease. However, when due to a centric origin it is not so bad, as hæmorrhage in the brain may terminate in a spontaneous cure; nor are instances wanting of destructive processes in Casser's ganglion being arrested, and of the effects of the pressure of adjoining tumours having ceased. In this respect the cases communicated by Bell and Abercrombie[2] are of great interest.

As regards *treatment,* we have on the whole to pursue the same principles as those in histrionic paralysis. If we wish to apply issues, the best place to select is the vicinity of the occiput.

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[1] Müller's Archiv für Anatomie, &c., 1838, p. 313.

[2] Pathological and Practical Researches. &c., 3d ed., p. 425.

CHAPTER XXXVII.

PARALYSIS OF THE OCULOMOTOR, TROCHLEAR, AND ABDUCENS NERVES.

The muscular appendages of the eye have become the subject of many researches, since Bell first drew attention to them, and since the introduction of the operation for strabismus; they are still the subject of physiological discussion, and pathological observations have as yet failed to afford any definite information on the point of most uncertainty, the action of the oblique muscles.

Paralysis of the eyelids, organs that are essential to the healthy functions of the eye, and even of great consequence to the performance of vision, occurs in two forms:[1] 1. As paralysis of the orbicularis muscle, which is supplied by the palpebral ramifications of the facials, accompanied by an inability to close the lids (lagophthalmus paralyticus), of which we have already spoken. 2. As paralysis of the levator tarsi muscle, which is under the control of the oculomotor nerve, (blepharoplegia, sive ptosis paralytica.) The upper lid hangs partially or entirely over the eye, but rarely so far as to touch the lower lid, as a small portion of the fissure remains uncovered, and exposes a little of the white of the eye. It has lost its power of elevation, and if raised with the finger, and let go again, it sinks down lazily. Ruete,[2] in his excellent observations on paralysis of the oculomotor, points out, that in paralytic ptosis, the capability of closing the eyes more firmly, and again relaxing them by an alternate contraction and relaxation of the fibres of the orbicularis, continues; it follows, that the relaxation of a muscle may be produced not only by the force of its antagonist, but also idiopathically and spontaneously.

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[1] See Tourtual; über die Function der Augenlieder beim Sehen, in—Müller's Archiv, 1838, p. 316.

[2] Klinische Beiträge zur Pathologie und Physiologie der Augen und Ohren, p. 242.

Paralysis of the eyeball, ophthalmoplegia, is either complete or partial; in the first case, the eye is entirely deprived of movement upwards, downwards, or laterally; and remains in the position it once occupies. The only direction in which the bulb is able to turn is, as Ruete has observed, downwards and outwards. This rotation follows the segment of a small circle, which is the line in which the pupil moves when the upper oblique muscle alone acts. In performing this rotatory movement, it is necessary that the tension of the external rectus muscle of the eye, by which, in paralysis of the oculomotor, the pupil is fixed in the external angle, be overcome. But as the rectus externus is more powerful than the obliquus superior, the contraction of the latter soon remits; the consequence is, that the pupil, even against the will of the patient, after a short time rotates in the same segment of the small circle, and resumes the direction which the unopposed tension of the external rectus gives it. At the same time there is ptosis and immobility of the moderately dilated pupil. In partial ophthalmoplegia, the eye is unable to turn in a definite direction, and is drawn by the antagonist of the paralysed muscle to the opposite side; this destroys the parallelism of the two eyes, and gives rise to strabismus (strabismus paralyticus). Thus when the rectus internus is paralysed, the eye is directed to the temporal angle; to the nose when the external rectus, upwards when the inferior rectus, and downwards when the superior rectus, is paralysed. When the oblique muscles of the eye are the seat of the paralysis, the rotatory movement of the bulb is said to cease, so that when the patient is told to bend his head to either shoulder, without changing the position of his eyes, the affected eye remains fixed, and does not follow the rotations of the healthy eye.[1] The abnormal position of the eye gives rise to other phenomena; one series affect the faculty of vision; so long as the squinting eye continues to see, and the patient attends to it, binocular vision is present. Szoklaski has pointed out that a peculiar kind of overlying images is a symptom accompanying paralysis of the trochlear nerve.[1]

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[1] Szokalski; de l'Influence des Muscles obliques de l'œil sur la Vision et de leur Paralysie; Paris, 1840.

In complete ophthalmoplegia, the bulb is not turned up under the eyelids when they are closed, as in health, and as first described by Sir C. Bell; and on this account, the patients constantly complain of luminous impressions in spite of the eyes being closed. Thus, one patient said that he saw a red light before his closed eye, another said, that the night-light caused him inconvenience.[2] The influence exerted by the immobility is not limited to the function of sight, but also influences the function of nutrition; the eye is not duly moistened by the tears, and thus inflammation and opacity of the cornea may occur. Another sequel, which rarely fails to show itself, is contraction of the antagonist to the paralysed muscle.

The paralysis of the iris, iridoplegia, is manifested by immobility of the pupil under the influence of light, the pupil being dilated (mydriasis) or contracted (myosis), the free margin remaining either normal or becoming distorted or changed in its direction.

The causes and symptoms of this variety of paralysis vary according to whether the cerebral or reflex conducting power of the nerve is involved. In the former case the loss of movement under the control of the will is characteristic. The causes either operate on the peripheral or central tract of the motor nerves of the eye.

1. *Peripheral affection of the oculomotor, trochlear, and abducens.*—A rheumatic cause, though not so frequently as in

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[1] In one case the movements of the pupils and the recti muscles remained unaltered, but the centre of the left cornea was directed rather more downwards than it was in the right eye; at the same time there was double vision, with overlying images. When the right eye was closed, the upper image disappeared, the lower one did so when the left eye was shut. If the head was inclined to the left, the images separated more and more, when the head was inclined to the right only one image appeared. The same was the case in the other instance; there were a few injected vessels at the external angle of each eye, which served Szokalski as a guide, whilst taking hold of the head of the patient by the temples and alternately turning him to the right or the left. The affected eye remained lying at the bottom of the orbit, and followed the movements of the head; while the healthy eye performed rotatory movements in the orbita.

[2] Bell; loc. cit., p. 266.

the case of the facial, paralyses the palpebral branch of the oculomotor, and is followed by simple blepharoplegia, without implication of the muscles of the eye, and the contractile fibres of the iris, according to the law of isolated conduction. The other branches of the oculomotor are less frequently, and the abducens most of all affected by this cause. Dr. Dahling has observed a case which has been published by Stromeyer,[1] where the facial and abducens nerves of the left side were suddenly paralysed, in consequence of a current of air blowing upon the heated face. The left eye was immovably directed inwards and downwards, the right bulb was turned to the external angle of the eye, and could be returned with some effort to the axis of vision; the movement was more easily effected when the right eye was closed. This gave rise to double vision; in which the true image was above, the false one to the side of and below the other. When the right eye was closed, the patient saw the object singly. The preponderance in this case of the symmetrical muscle of the eye of the healthy half of the face, is a point of particular interest. External injuries in the vicinity of the eyelid are often followed by blepharoplegia. Tumours of the orbit occasionally compress the muscular nerves of the eye; this was the case in a young woman, observed by Shaw, suffering from a fungous tumour below the maxilla. The cheek of the same side was paralysed—the upper eyelid being down; but if raised, the patient was perfectly able to see distinctly, though the pupil was dilated and immovable. At the post-mortem, the tumour was found to have extended into the lateral part of the orbit. The trochlear nerve passed above the tumour, the oculomotor was included in its tissue, the ophthalmic branch of the fifth nerve was most disorganized, and the abducens had only suffered at a few points. The tumour did not extend to the optic nerve. The diagnostic criteria of cases of this kind are, in addition to the objective symptoms in the form and position of the eyeball, the implication of the ophthalmic branch of the fifth, which is manifested by anæsthesia of the surface of the eye and the forehead, and the integrity of the facial nerve, as shown by the persistent power of closing the eyelids. The peripheral causes of paralysis of the muscles of the eye are much more frequently seated within the cranial cavity at the base of the brain; they are most commonly sero-albuminous exudations and sanguineous extravasation; tumours give rise to it less frequently, and when they do so, they implicate the adjoining cerebral nerves more or less, according to their extent. The symptoms of a cerebral affection have generally preceded or coexist. Bell has communicated a few cases. One patient had been suffering from febricitations for a week, upon which sopor and delirium supervened. When he began to wander he lost the power of opening the right eye; on raising it with the finger, it was evident that the movements of the ball had also ceased; while the left eye rolled from one side to another, the right remained at rest, and was directed rigidly forwards. When the eyelids were held apart, resistance was felt on the part of the bulb and the orbicularis, which closed the eyelids with full power. At the post-mortem, a considerable quantity of serous fluid was found in the cerebral ventricles. The removal of the brain, which is generally accomplished with facility, was prevented by a thick layer of coagulable lymph, of a straw colour, and gelatinous consistency, which caused an adhesion between the upper part of the pons Varolii and the dura mater. This layer was most dense to the right of the sella turcica. All the nerves passing to the orbit were enveloped in this matter, and more particularly the third, which presented a brownish-yellow appearance. The corresponding nerves of the left side were also, though in a less degree, affected. The point of insertion of the facial nerve was removed from the seat of the disease. In the other case, a scrofulous boy of 11 years of age, double vision, squinting and ptosis of both eyes, had supervened suddenly. The faculty of closing the eyelids and of blinking, as well as the power of vision, were undisturbed. The left eye moved but partially, the right had a staring look; the left iris was alone moveable, the right pupil was dilated. After a few months, the condition of the patient grew worse. Pain in the right arm and in the head supervened. The muscles of the thumb wasted, and soon after the entire arm became atrophied and paralysed. The paralysis extended over the entire body. Sectio cadaveris: The ventricles of the brain contained about ten ounces of serum; the cerebral tissue was diffluent, and the serum of the ventricles contained flocculi. Several tubercles were found in the cerebellum and pons Varolii. An exudation of lymph was discovered at the base of the brain, enveloping the origins of all the nerves, from the olfactory to the ninth pair. The fifth pair were least affected; the oculomotor of the right side could scarcely be recognized in the exudation, was disorganized, and had become transparent.[1] In 1839, I was called to see a boy of 3 years, who nine months previously had had a severe fall down stairs. On the 20th of March, the disease commenced with vomiting and diarrhœa, followed by high fever and confusion of intellect. On the 22d, there were marked symptoms of cerebral meningitis, with ptosis and blindness of the left eye, which was permanently turned to the external angle, and did not exhibit the slightest reaction to the stimulus of light. The sopor became more profound, and death ensued with violent convulsions of the extremities. During the last two days, the right eye also appeared to have lost its power of vision. The pupils were dilated and immovable. On examination after death, the central portions of the brain, the corpus callosum, the fornix, the septum lucidum, and the walls of the lateral ventricles, which were dilated and filled with a quantity of serous fluid, were found softened. At the base of the brain, especially at the anterior lobes to the floor of the third ventricle, there was evidence of intense meningitis. An extensive albuminous exudation enveloped the optic nerves, the chiasma, and the oculomotor; it was most marked on the left side. Hugh Ley[2] has found that in several cases of exudation at the base of the anterior lobes accompanied by thickening of the membranes, the paralysis was confined to the superior recti muscles of the eye, and he also points out that the fibres of the oculomotor which supply these muscles, pass off from the trunk of the nerve before it traverses the dura mater, and may, from the delicacy and thinness of their neurilemma suffer from a pressure which would be insufficient to affect the larger trunk.

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[1] Physiologische Bemerkungen am Krankenbette von Stromeyer, in — Casper's Wochenschrift für die gesammte Heilkunde, 1837, p. 97.

The following case, which has been recorded by Stumpff,[3] is an instructive instance of ophthalmoplegia resulting from compression, that was confined to the oculomotor. A carpenter, aged 22, who had frequently been affected with headache, while engaged in some heavy work, on the 4th of September, 1835, was suddenly seized with vertigo and intense headache, and fell down. When he recovered himself, he complained of violent throbbing pain in the whole head; and desired to be admitted into the hospital. His eyes shunned the light, and were red; the head was bent back. The nights were sleepless, the headaches became intolerable, and convulsions supervened. Antiphlogistic treatment relieved him, and the patient, though not cured, left the hospital. A short time after, the headache returned with violence, accompanied with the following symptoms: the right bulb was immovable and was turned to the temporal angle; the pupil was dilated and immovable, there was ptosis, and the patient complained much of a dull, oppressive pain in the eye, especially when light fell upon it. The pupil was clear, and seeing was not impaired. The left eye was somewhat reddened and photophobic. The patient was again received into the Charité, was one night seized with an apoplectic attack, and died soon after. A considerable hæmorrhagic clot was found at the post-mortem examination, enveloping the entire brain, and chiefly accumulated in the vicinity of the fossa sylvii. Its source was an aneurism placed at the angle of the ramus communicans of the basilar artery and the artery of the fossa Sylvii; it was of the size of a hazel-nut, and of oval shape; it was connected by a narrow pedicle with the artery, and was formed by its dilated vessels. Its lower surface rested upon the oculomotor, and compressed it. At this point the coats of the artery were softened and pulpy, and presented a fissure of two lines in length. In the vicinity of the aneurism the cerebral tissue was softer than elsewhere.

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[1] Bell; loc. cit., p. 380.

[2] An Essay on Laryngismus Stridulus, p. 47.

[3] Dissertatio Inauguralis, de Aneurysmatibus Arteriarum Cerebri; Berol., 1836.

2. *Centric affection of the oculomotor, trochlear and abducens.* —According to the law of crucial conduction that governs the central apparatus of the brain, the opposite hemisphere is the seat of disease, and the paralysis of the muscles of the eye is found on the same side as the paralysis of the extremities. Ptosis is not unfrequently a symptom of central affection, while lagophthalmus is so only exceptionally; it is generally associated

with ophthalmoplegia and optical anæsthesia. Of the nerves of the ocular muscles, the oculomotor is more frequently involved in central affections than the abducens, and especially the branch supplying the rectus internus and superior; thus strabismus divergens accompanies hæmorrhages and softening, and in chronic hydrocephalus the bulbs are very often turned downwards and incapable of being elevated. Yelloly[1] mentions a case of paralysis of the external rectus, in which the bulb was turned inwards, and which was caused by a tumour of the left side of the fourth ventricle of the brain.

We must make a distinction between cerebral paralysis of the muscles of the eye and reflex immobility, which may be recognised by the cessation of certain movements, on account of the diminution and loss of sensory and sensual stimuli, while the movements that are under the control of the will continue. We have already had occasion to point out that the equilibrium of the movements of the eye depends upon the vigour of the optic nerve; Von Walther[2] possesses the merit of having properly estimated these phenomena occurring in the muscular nerves of the eyes, of having seen their bearing upon amaurosis, and of having properly estimated their physiological relations. The characteristic stare of the amaurotic eye is the expression of the torpidity of all the muscles of the bulb; but it is chiefly the oculomotor, and especially the branch that goes to the rectus internus, whose activity is diminished on account of the impaired vigour of the optic; amaurosis is, therefore, generally accompanied by strabismus divergens.[3] The arrest of movement more rarely affects the levator palpebræ superioris. Patients are able, through the influence of the brain, e. g., when told to do so by the physician, to move the eye, to turn it towards the nose, or to raise the upper eyelid, but although they are able to do so they do not do it of their own accord, because the stimulus of vision no longer affects them. They occupy the same position as those who labour under anæsthesia of the first division of the fifth pair, in whom the blinking of the eyelids, on the approach of foreign bodies, has ceased, although when required to do so the patient is able to close the eyelids freely, and can imitate the blinking movement. It is of consequence that the longer the reflex influence of vision upon the motor plexus is in abeyance, the less capable it becomes of receiving a cerebral stimulus; in the same way when the cerebral excitability is destroyed the reflex activity suffers. Nor should we overlook the fact that in centric amaurosis the spread of the disease to the central tracts of the muscular nerves of the eye, may deprive the latter of their power of conduction.

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[1] Medico-Chirurgical Transactions, vol. i, p. 218.

[2] Die Lehre von schwarzen Staar und seiner Heil-Art.; Berlin, 1841, p. 75.

[3] See—Böhm's excellent Monograph, Das Schielen und der Sehnenschnitt, in seinen Wirkungen auf Stellung und Sehkraft der Augen, 1845, p. 212.

The absent reaction of visual excitement in amaurosis not only manifests itself in the muscles of the eye, but also in the contractile fibres of the iris; the pupil is generally immoveable and accompanied by a deviation of form and position. The inquiries as to the source of the movements of the iris are of considerable interest, and promise physiological results for the entire doctrine of the motor phenomena. Mayo[1] was the first to establish the influence of the oculomotor. When this nerve is irritated within the cranium, contraction of the pupils results; when it is divided, the pupils dilate. The latter has generally, but improperly, been considered as a passive condition or a state of relaxation; the experiments instituted by Petit in 1712, and subsequently confirmed by Molinelli and later inquirers, have shown that division of the cervical portion of the vagus and sympathetic in living dogs, instantly induces a permanent contraction of the pupils of the corresponding eye. The same result was obtained when Dupuy and Dupuytren divided the upper cervical ganglion of the sympathetic, so that this alone would serve to prove the existence of motor fibres passing upwards through the ciliary ganglion to the iris, to which the dilatation of the pupils may be attributed. Very recently Valentin,[2] by his experimental researches, has placed this matter upon a firmer footing. His investigations demonstrate the antagonism existing between the motor stimuli in the nervous elements of the iris that are derived from various sources, whether cerebro-spinal or sympathetic; they also show that the shape, both of natural and artificial pupils, depends upon the relation of these stimuli to one another. If the upper ganglion of the sympathetic, the ganglion of the vagus, their trunks or the fibres of the cervical nerves that unite with them are irritated, the pupil becomes dilated; if they are divided and thus deprived of their conducting power, the oculomotor acquires the upper hand and contraction ensues. The converse is also the case. These investigations assist in the interpretation of pathological phenomena. When there is cerebral irritation we find the pupil contracted, when the sympathetic is irritated, as in helminthiasis, it is dilated; paralytic affections of the brain are associated with mydriasis, while in tabes dorsalis I have found the pupil contracted to the size of a pin's head. It has not as yet been determined whether the mydriasis following the instillation of infusion of belladonna or hyoscyamus into the eye, results from paralysis of the fibres of the oculomotor or from stimulation of the sympathetic. We may trace the paralysis limited to individual nerve fibres better in the iris than in other muscles, and also determine the preponderating influence of the other healthy fibres by the disfigurement of the pupil. Valentin asserts that he has noticed definite changes in the pupil according to whether the ganglion of the vagus or the superior cervical ganglion was experimented upon. Injuries inflicted upon individual ciliary nerves in operations upon the eye, occasionally give rise to the pupil being directed upwards or inwards, or to some other quarter; the changes in the configuration of the free margin of the iris, the horizontally or vertically oval, which have been made use of to determine the diagnostic criteria of the varieties of amaurosis, can only be attributed to an unequal distribution of the paralysis of the different ciliary nerves.

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[1] Anatomical and Physiological Commentaries; London, 1823.

[2] De Functionibus Nervorum Cerebralium et Nervi Sympathici, p. 109.

There are other states of inactivity in the muscles of the eye besides reflex immobility, which should not be confounded with paralysis. In persons whose two eyes possess a different range and power of vision, we find the motor energies less exercised; they are apt, at a medium distance, only to look with one eye, while the other eye, as it were, goes to sleep. Thus we also find strabismus accompanied by ptosis, if the eye is incapable from its altered position, of being employed for seeing. Dieffenbach[1] has observed that the affected eye could be opened much wider when the healthy eye was closed, although no improvement was manifested in the position of the bulb. We must lastly advert to the relaxation of the external rectus, which Bell[1] has shown by pathological arguments, to be a frequent cause of strabismus convergens. It would scarcely be possible to explain this relaxation of a single muscle without remembering the double source from which it derives its motor powers; the one being of cerebral origin by means of the sixth pair of nerves, the other sympathetic by ascending fibres derived from the upper cervical ganglion of the sympathetic, which are in approximation with the abducens. Petit already observed, and it has been since confirmed by others, that after division of the cervical portion of the sympathetic, the eye is invariably drawn to the inner angle; while, on the one hand, the withdrawal or loss of this impulse weakens the energy of the external rectus and causes the contractile muscular tissue to relax, although cerebral conduction may continue unimpaired along the abducens; we can, on the other, easily account for the external rectus being especially implicated in affections of organs governed by the sympathetic, (Helminthiasis, Hysteria.)

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[1] Ueber das Schielen und die Heilung desselben durch die Operation, p. 162.

The *treatment* depends; 1, upon fulfilling the etiological indication; we must proceed against the rheumatic or traumatic cause, as in other cases we should try to promote absorption and the removal of dyscrasic processes. This, however, rarely suffices to establish a cure; we must, therefore; 2, seek to restore the excitability and conducting power of the muscular nerves of the eye. It has been attempted to achieve this by the local employment of irritant and derivative measures; and beginning with aromatic and ethereal frictions, (balsamus vitæ Hofmanni, ol. cajeputi, spiritus etheris sulphurici,) and passing to the application of blisters and moxæ in the vicinity of the eye. The latter, especially white heat, belong to the more effectual agents for the cure of ptosis and ophthalmoplegia, the former, on the other hand, are generally useless. Electricity in its various modes of application, whether as electro- or galvano-puncture, or by means of the electro-magnetic rotatory apparatus, rarely produces any permanent effects. The same applies to the douche. We may expect better results from derivative remedies,[1] and issues, (emplastrum vesicatorium perpetuum, the unguentum or emplastrum antimonii potassio-tartratis,) especially when we have to deal with a rheumatic or dyscrasic constitution. I must here draw attention to an error which is kept up through ignorance of the recent progress in neurology, and is the more difficult to eradicate because it has the sanction of a celebrated name. I allude to the application of a cauterising paste between the mastoid process and the angle of the jaw, recommended by John Ad. Schmidt. This is, probably, owing to the curative powers which it is known to possess in lagophthalmus, for counter-irritation applied at this point is less effectual for the cure of paralysis of the oculomotor, than when applied in the vicinity of the eye. The endermic application of strychnine may be combined with the issue, in the same manner as in paralysis of the facial nerve.

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[1] Practical Essays; Edinburgh, 1841, p. 62.

Surgery has of late acquired some merit in the treatment of muscular paralysis of the eye. Dieffenbach,[2] to whom science is most indebted in regard to this point, found that the slighter degrees of ptosis, which occasionally accompany squinting, disappear after the successful operation of the latter. In other more serious cases, division of the antagonising muscle, the orbicularis palpebrarum, was effectual; from this we may conclude, that in blepharoplegia, we have to do not only with paralysis of the levator tarsi, but also with an increased action of the sphincter muscle, the reverse of what obtains in lagophthalmus. In ophthalmoplegia, the division of the antagonist of the paralysed muscle acts in a similar manner; the operation of strabismus paralyticus should be valued, not only in a cosmetic point of view, but also in reference to the influence it exerts upon the maintenance and improvement of vision.

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[1] [Empl. vesic. perpetuum, is made with one part of cantharides to fifteen parts of empl. resinæ.]—Ed.

[2] Loc. cit., p. 164.

CHAPTER XXXVIII.

PARALYSIS OF THE HYPOGLOSSUS NERVE.

The motor action of the tongue is not less comprehensive than the sensory, and equally requires elucidation. Although the difference between the masticatory and articulating movements of the tongue is more frequently manifested than in the convulsive diseases, the pathological observations hitherto made have not explained the nervous levers of this double action, as has been done in reference to the histrionic and masticatory movements of the facial muscles; nor could it be otherwise, as long as the hypoglossus was regarded as consisting of identical elements. But like all other nerves, it is only a tract in which primitive fibres of a different origin are associated; and Volkmann[1] has shown by microscopic researches, that the descending branch is an ascending one, conveying fibres from the two upper cervical nerves to the hypoglossus and the tongue.

The articulating and masticatory paralysis of the tongue occur either isolated or associated with one another.

1. *Glossoplegia masticatoria.*—The movements of the tongue are either entirely or partially arrested. The formation of the morsel in the mouth is executed laboriously, or it cannot be done at all; the food remains lying on the paralysed side, because the tongue does not move it; there is also a difficulty or inability to masticate and to swallow. Sensation is undisturbed in the uncomplicated cases; taste is more obtuse on account of the impaired powers of movement. There is generally an accumulation of the saliva that is not wanted in the cavity of the mouth. Panizza[2] was the first accurately to describe the result of dividing both hypoglossi; he says, "that the dog, after having fasted for a time, approaches the basin with milk that is placed before him with great apparent

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[1] Müller's Archiv, 1840, p. 502.

[2] Versuche über die Verrichtungen der Nerven, translated by Schneeman; Erlangen, 1836, p. 31.

relish, but is unable to protrude the tongue in the least, so that after a few vain attempts he relinquishes it. He seizes a piece of bread moistened with milk, tries to chew it, but soon drops it, scarcely divided into two parts; he will then again seize it, till at last he leaves it broken up into small pieces. If during the movements of mastication, from the head being bent, the tip of the tongue protrudes from one angle of the mouth, it hangs out loosely, the animal bites it and utters a howl in consequence. If the mouth is opened the tongue is seen to be perfectly immoveable and lax, and it remains in any position that it may be placed in. If a piece of bread or meat be laid on the dorsum of the tongue, it remains there unless it is caused to fall out by the movements of the jaws, or is jammed in between the tongue and the teeth. Deglutition is not effected, unless perhaps the morsel reaches the cavity of the pharynx by the mere action of the pharyngeal muscles; but even in this case it is only performed ineffectually, because the morsel on being compressed by those muscles is broken up and partly returns into the mouth through the open isthmus of the fauces, which the tongue no longer closes up. The same occurs when fluids are poured into the dog's mouth."

When there is complete glossoplegia the articulation is also arrested, and the tongue lies stretched out like a wedge at the bottom of the oral cavity, behind the teeth of the lower jaw. When there is partial paralysis of the tongue, its movements and position are abnormal. Hemiplegia is the most frequent affection of the kind. The tip of the tongue, when protruded, is turned towards the paralysed side. I have recently had an opportunity of observing this phenomenon in a patient, after the extirpation of a small carcinomatous growth on the left half of the tongue, by which the fibres of the hypoglossus had been injured. It is the more marked if the facial muscles are paralysed at the same time, and the angle of the lips is drawn to the healthy side; various explanations have been offered to account for the circumstance. Bidder considers the cause of the oblique position of the tongue to depend upon the arrested contractile power of those muscles which raise the hyoid bone on the paralysed side. For if, when it is attempted to put out the tongue, the elevation of the hyoid bone is left to the muscles of one side only, the hyoid must assume a slanting direction to the lower jaw, and consequently the tongue to the cavity of the mouth; a position which must necessarily be encouraged by the paralysis of the genioglossus of the same side and the overbalancing of the corresponding muscle of the opposite side. This is confirmed by the fact, that the abnormal position became the more marked, the more carefully in dividing the hypoglossus of the living animal all the branches given off before the point of section and passing to the muscles in question were also destroyed.[1] I must, however, observe, that in extirpating or excising morbid growths from the side of the tongue, as the late Professors Rust and Dieffenbach have informed me, the tip of the tongue turns to the side operated upon, without any contraction being visible or perceptible to the touch, as a result of the operation. We less frequently meet with partial glossoplegia in the shape of paralysis of the muscles that draw the tongue forwards or backwards. Müller[2] has pointed out that, after the extirpation of the middle portion of the lower jaw, by which the os hyoides and the muscles that draw the tongue forwards (mylohyoid, geniohyoid and genioglossus), lose their point of attachment, the os hyoides is drawn back so forcibly by the stylohyoid, and the tongue by the styloglossus, that there is great danger of suffocation. Atrophy follows paralysis in the muscles of the tongue more rapidly than in other paralysed muscles. Bidder always found that the nutrition of the tongue was impaired during the first week after the division of the hypoglossus, in living dogs, though in no case a vessel of any magnitude had been injured. Large and deep transverse rugæ were visible on the surface of the tongue, as if the envelope of the organ had become too loose for the diminished fleshy contents; a manifest difference was perceptible between the two valves. The marked wasting of the tongue is especially alluded to in the cases that will follow.

2. *Articulating glossoplegia.*—The movements of the tongue, as bearing upon the formation or modulation of the voice, are either arrested or impeded. In the former case we have to deal with dumbness (mutitas), in the latter with thickness of speech or stammering. The investigations of Kempelen and later writers have demonstrated the mechanism of the move-

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[1] Müller's Archiv, &c., 1842, p. 111.

[2] Handbook of Physiology, Dr. Baly's transl., vol. ii, p. 925.

ments of the tongue. Dr. Bennati[1] has shown its movements in singing. In singing high notes the tongue draws back and expands; in the falsetto notes the edges are raised, and form a semiconical channel. Singers who are affected with this variety of glossoplegia are consequently unable to modulate their voice in its entire extent, and, more particularly, to produce the high notes of the head—or falsetto voice. In dumbness the movement of the tongue and its function of deglutition are occasionally impaired, but in stammering they are generally unaffected.

The causes giving rise to glossoplegia very rarely reside in the peripheral distribution of the motor nerves of the tongue. A curious case of this kind, in which the nerves adjoining the hypoglossus were also affected by compression, has been accurately described by Gendrin.[2] The patient, a man aged 36 years, had three years previously been precipitated down stairs on the nape of his neck; and the accident was followed by severe pain in the neck, with increased difficulty of movement and of speech. Four months later he returned to his business, and continued to attend to it for a year, but the pains in the left side of the neck persisted and extended to the arms; the voice became hoarse and weak, and the patient grew thin. He was now admitted into the Hôtel Dieu; the left half of the tongue was atrophic, but continued in the possession of sensation and taste. Dupuytren diagnosed an affection of the left hypoglossus at its point of exit from the cranium. The patient subsequently came under the treatment of Gendrin.[3] The left half of the tongue was atrophic in a marked degree. The permanent oppressive pain at the back of the neck extended to the occiput. The nape of the neck was stiff, and the power of moving the head so much impaired, that the patient could only raise his head from his pillow by employing both hands. Six months later his condition was described as follows:—The left half of the tongue was so thin, that it appeared to consist of the laminæ of the mucous membrane only; its shape was irregular; when protruded, it curved to the left side. The pain in the neck was of a dull character when the patient remained quiet, but was augmented by every movement of the head, for which reason the patient remained constantly in the horizontal position, and when he raised himself he supported his head with both hands. The muscular power was weaker in the extremities of the left side than in those of the right; the bowels were obstinately constipated; the evacuation of the bladder was only effected by regurgitation. Memory was almost entirely extinct, and there was considerable emaciation. The sensibility of the atrophied half of the tongue was undisturbed; pricking with a needle, heat and cold, produced the same sensations on either side. Sapid substances, colocynth, salt, acetic acid, only excited a very obscure impression of taste on the atrophic half, which was not experienced for seven or eight minutes after the application was made, while they were tasted vividly on the healthy side after a minute or a minute and a half. During respiration the intercostal muscles remained inactive. Deglutition was impeded, the morsel remained in the pharynx or penetrated to the larynx, causing violent coughing. The aphonia increased. The alvine and renal discharges were effected involuntarily. Aphthæ, sopor, and pulmonary paralysis supervened, and three years after the occurrence of the injury the patient died.

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[1] Etudes Physiologiques et Pathologiques sur les Organes de la Voix Humaine; Paris, 1833.

[2] In his translation of Abercrombie,—Des Maladies de l'Encéphale et de la Moëlle Epinière, p. 627.

[3] See Montault, in the Work by Panizza, already quoted, p. 112.

Sectio Cadaveris.—A ruptured hydatid cyst was found between the left hemisphere of the cerebellum and the medulla oblongata, out of which six hydatids had issued; two of the size of a hazlenut, the others of the size of a large pea, the largest being attached to the entrance of the calamus scriptorius. About five or six similar hydatids were retained in the sac, one of them being as large as a chesnut. The cyst extended forwards on one side, between the anterior lateral edge of the occipital foramen and the point of the os petrosum, passing out of the skull by the anterior condyloid foramen and the foramen lacerum. The portion that had issued by the condyloid foramen formed a small tumour behind the hypoglossus, which was very much smaller after the union of its roots than its fellow on the right side. That portion of the hydatid cyst which passed through the foramen lacerum formed a tumour behind the mastoid process, and extended from behind forwards, and downwards between the muscles of the neck, so that it was covered by the splenius, the sternomastoid, and the posterior belly of the digastric. In the foramen lacerum the cyst had pushed the nerves forwards. The trunk of the vagus, and especially the pharyngeal branch and the superior laryngeal, were fine and attenuated. The glosso-pharyngeus was attenuated to the last degree, and resembled a neurilemmatous sheath. The muscles of the tongue, of the velum palati, and pharynx, were atrophied on the left side, and scarcely presented a third of their normal volume; their tissue was of a whitish hue, and resembled indurated cellular tissue. The arteries distributed to these muscles were small and hard, as if obliterated. With the exception of an accumulation of clear serous fluid in the dilated ventricles, the brain presented a normal appearance. At the lower surface of the middle lobe of the liver there was an hytadid cyst of the size of a turkey's egg, containing two large hydatids.

In the following case, which I have had the opportunity of examining for a considerable period, it appears that there is a compression of both hypoglossi at their point of insertion.

A widow of 69 had suffered from violent lacerating pains at the occiput and back of. the neck. These were followed by difficulty of speech and deglutition. When she came to me for advice in 1842, her speech was thick and indistinct, and difficult to understand, whether she whispered or spoke loud; the saliva ran from the overfilled cavity of the mouth; the genioglossi were paralysed, and it was with extreme difficulty that the patient protruded her tongue, which she had scarcely done when it was instantly drawn back by the styloglossi. The lateral movements were less impeded. The tongue was much atrophied, and had lost its smooth uniform appearance; its surface was covered with deep furrows, and raised in folds, which were constantly oscillating. The patient stated that her sense of touch and taste was more obtuse than formerly; but she felt the pricks of a pin distinctly, and when powdered colocynth was strewed upon the root of her tongue, she tasted it rapidly and distinctly. The temperature of the tongue was normal, and it was constantly covered with a thin white moist fur. Deep pressure under the angle of the lower jaw, upon the upper cervical vertebræ, and the lateral muscles of the neck, caused pain. The motility of the head, the extremities, and the respiratory muscles, was in no way affected. There was no trace of external injury, or of any constitutional disease. Issues applied to the nape of the neck produced no effect. During the succeeding years this patient was often presented to the clinical students. All the muscles of the tongue were seized with paralysis, so that the tongue lay in the cavity of the mouth like a block of wood; the front teeth of the lower jaw left indentations upon the forepart of the tongue. The atrophy and division into separate fasciculi increased, and the oscillation of the muscular fibres was augmented in proportion. The power of speech has entirely ceased, mere inarticulate notes can be heard, which the patient's daughter has learnt to understand by practice. Deglutition has ceased, the patient is obliged by dint of her fingers to push the soft morsel over the dorsum of the tongue into the pharynx, and to bend the head backwards when she drinks. It is manifest that the vagus has now become involved, and by day and at night there are suffocative attacks of respiration, with a whistling sound. The muscles of the neck, especially the sterno-cleido-mastoid and the trapezius lose their energy, and an oscillation is seen in their fasciculi. The head can no longer be maintained in the upright position, or be sent backwards, but at once falls forwards. On the other hand, the motility of the extremities and the integrity of the intellect continue unimpaired. The emaciation has reached an extreme point, and death from starvation is unavoidable.

Rare as peripheral causes of paralysis of the tongue are, we find central affections giving rise to it very frequently; they may induce either or both forms of glossoplegia. When the cervical portion of the spinal cord has been injured by fracture of the vertebræ, the articulating functions of the tongue are often involved; the patient is not only unable to speak continuously on account of the difficulty of respiration, but he speaks indistinctly or thick, or is entirely deprived of the power of articulation. The spinal paralysis from lead poisoning is occasionally accompanied by glossoplegia.[1]

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[1] Tanquerel des Planches; Traité des Maladies de Plomb, vol. ii, p. 62.

Affections of the medulla oblongata exert a still more marked influence.

Wilhemina K—, a girl of 22 years, who had got rid of fetid perspirations of the feet by washing them with cold water, was attacked with headache; in January, 1832, she had a severe fall in the street, striking the back of her neck against a slab of granite. She managed to drag herself home with a great effort. On relating the circumstance to her mother she could not do so with fluency, but stammered. Her urine was discharged involuntarily; the headache continued; the limbs, especially those of the right side, became paralysed, and her memory vanished. The patient every day found more difficulty in speaking; if reproached with it, she commenced stuttering to such an extent that it was impossible to understand a word she said. Her appetite became ravenous, deglutition was somewhat impaired, especially at first. Six months after the attack she was idiotic, and unable to hold the head in any position. Her power of speech had entirely disappeared, but her hearing was unimpaired; sopor supervened, and death ensued soon after, on the 24th October, 1833. The relations would only consent to the cranium being opened. A considerable amount of gelatinous fluid was found between the opaque, and thickened arachnoid and pia mater of the cerebrum; the consistency of the brain, including those parts which are usually softer than the rest, was throughout very firm and elastic. The lateral cavities were dilated to double their usual size, and full of a thin serous fluid. The rhomboid fossa of the medulla oblongata appeared to be the seat of a peculiar change. It was covered throughout, between the restiform processes, with a number of yellow warty excrescences of the size of millet-seeds, which felt rough and granular; Professor Müller and myself examined them at once minutely, and found that they rested upon the white striæ, (striæ medullares;) these may be looked upon as the roots of the auditory nerve, which in this instance was in no way affected. We were of opinion that it had originally been an albuminous exudation which had gradually assumed this form. The preparation is preserved in the University Museum in Berlin, and has been delineated in the inaugural dissertation of Otto Fischer: "De raro encephalitidis casu, deque striis medullaribus in ventriculo quarto obviis."—Berol. 1834.

Among the diseases of the brain, hæmorrhage, and more especially softening, are most liable to be followed by glossoplegia, (see the chapter on Cerebral Paralysis.) Injury to the head, narcotisation and emotions, especially anger and fright, occasionally give rise to it. It was owing to the first cause, in the following case:—

A sailor boy, aged 15, while hoisting a sail, was struck by a loose rope on the left side of his head, and at once fell down in a state of insensibility. After a quarter of an hour he recovered himself, but was found to have lost the use of the right half of his body, and to have become speechless. The tongue, when protruded, was drawn to the paralysed side. In the coverings of the left parietal bone there was a wound several inches in length, bleeding profusely and penetrating down to the bone. Three weeks after the occurrence the boy was brought to the Policlinique. The motility of the extremities had been restored, and the tongue could be moved in every direction without difficulty, but the faculty of speech was arrested; although perfectly conscious, it was only with the greatest effort that the boy was able to utter a few inarticulate sounds. The left pupil was dilated, but acted normally under the stimulus of light. The father stated, and the patient gave us to understand by his movements, that he still felt an oppression in the head, which at times increased to giddiness. The bowels were costive. Some blood was taken locally by eight leeches, applied behind the left ear, and ordered to be repeated every four days, a solution of sulphate of magnesia containing small doses of tartrate of antimony being exhibited at the same time. On the 1st of June, three weeks after the commencement of treatment, his speech returned, and on the fifth he presented himself in his 'Clinique' perfectly restored.

When paralysis of the tongue is due to a centric affection, it is rarely isolated; but commonly associated with other paralytic states, such as paralysis of the respiratory and vocal muscles, the extremities, &c.

We must distinguish from the inexcitability and the loss of conducting power of the motor nerves of the tongue, the undeveloped state of their functions in congenital deafness, or deafness that has supervened early in life, in congenital or acquired idiocy, and in dementia.

There is little prospect of cure in glossoplegia; the prognosis is most unfavorable in the variety affecting articulation. After cerebral hæmorrhage, even after the other paralytic conditions and even that of mastication have been removed, the integrity of speech is rarely restored. The treatment consists mainly in the frequent repetition of cupping, in the application of issues and setons to the upper part of the neck. Electricity may be tried. It has often been recommended to let the patient chew acrid volatile substances, but this is useless.

CHAPTER XXXIX.

PARALYSIS OCCURRING IN THE RANGE OF THE NERVES WHICH CONTROL THE MOVEMENTS OF RESPIRATION AND VOCALISATION.

The great influence of accurate physiological investigation upon pathology has also been unequivocally manifested in the reform that has been effected in the doctrine of the paralytic affections of the respiratory muscles. The collective terms, asthma and suffocative catarrh, served to conceal the scanty facts and to envelop them with confused ideas. It is only since Le Gallois and Flourens have demonstrated that the medulla oblongata is the seat of the respiratory energies, that we have been able to explain the form of asphyxia which has a central origin. More recently, the results obtained by Le Gallois' experiments on the vagus have been used to explain the paralysis of the internal muscular apparatus of respiration; Hugh Ley[1] has done so in the most comprehensive manner, while it was Bell who gave the first impulse to the study of the paralysis of the respiratory muscles of the trunk, which have since been developed by Stromeyer.

Paralysis of the branches of the vagus supplying the muscles of the trachea.—To render the subject more intelligible, it may be well to premise:—1. That Volkmann, Reid, Longet, and others, agree that the superior laryngeal nerve exerts no influence upon the respiratory movements of the glottis, but that this function is to be attributed to the recurrent branch of the vagus. 2. That according to Longet's experiments upon larger animals, irritation of the pulmonary branches of the vagus produces contraction of the muscular fibres of the bronchi. 3. That the want of breath is not felt by the aid of the vagus, as Brachet, whose experiments prove to be very untrustworthy, has erroneously asserted. Volkmann's experiments show, that an animal whose vagi have been divided, does not, as Brachet states, die quietly when deprived of air, but manifests the most indubitable symptoms of suffocation and the same phenomena as an animal in whom the pneumogastric nerves have been left entire.[1] 4. Reid, whose experiments may serve as models of philosophical inquiries, found that sudden and violent fits of dyspnœa occurred after division of the vagi at the middle of the neck, and after the movements of the glottis had ceased; and that, unless they terminated in asphyxia, they ceased after a couple of minutes. As long as the animals were at rest, or only moved about slightly, they breathed with facility; but as soon as they exerted themselves, or were forced to breathe with more vigour, attacks of dyspnœa supervened, which were at once arrested if they were restrained from the exertion, or if the trachea was opened.[2] 5. When one vagus only is divided in the experiment, a disturbance of respiration is manifested. The respiration of a dog whose vagus was touched with a forceps, became laborious and sonorous. Galvanising the recurrent branch or pinching it with the forceps caused the arytenoid cartilages to approach one another, and the orifice of the glottis to close.[3] 6. Beside the direct effects, we must also attend to the secondary consequences, the changes taking place in the lungs and the blood. The lungs generally become gorged with dark blood, their parenchyma condensed, and an accumulation of spumous serum is found in the bronchi, even if respiration is maintained by means of a tube introduced into the trachea. The venous blood that circulates in the arteries is deprived of its property of stimulating the central organs of the nervous system, especially the medulla oblongata; coma and convulsions result. Marshall Hall has directed attention to this subject as a source of secondary asphyxia and death, after the animal or the human being had already been withdrawn from the injurious influence and had recovered itself.[4]

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[1] An Essay on Laryngismus Stridulus; London, 1836, p. 406.

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[1] Müller's Archiv, &c., 1841, p. 334.

[2] Reid's Experimental Investigation into the Functions of the Eighth pair of Nerves; Edinburgh Med. and Surg. Journal, vol. li, p. 273.

[3] Reid; ibid., p. 140.

[4] Marshall Hall—On the mutual relations between Anatomy, Physiology, Pathology, and Therapeutics, and the Practice of Medicine; London, 1842, p. 47.—See also Reid; On the Order of Succession in which the Vital Actions are arrested in Asphyxia, in Edinburgh Med. and Surg. Journal, No. 147.

I. PARALYSIS OF THE PERIPHERAL DISTRIBUTION OF THE VAGUS.

Injuries of the vagus, though not occurring frequently, present an analogy to experiments made upon animals. Several years ago I was present at the juridical post-mortem examination of a boy, in whom the right carotid artery had been tied on account of a serious wound in the neck and hæmorrhage. The vagus was found to have been enclosed in the ligature. Hugh Ley mentions a case of aneurism of the right subclavian artery, in which, after the ligature had been applied near the origin of the vessel, where the recurrent nerve turns round it, the patient was seized with dyspnœa and anxiety, which increased to such an extent that death appeared imminent during the operation. The paroxysms ceased after the ligature, which had not been tied very firmly, was loosened by the pulsation of the artery.

The vicinity of the vagus in its passage through the neck and the thorax, offers subjects for study in reference to the paralytic states of the nerve, on account of the swelling and induration of the parts exerting pressure upon the trunk or upon separate branches. Its conducting power is most frequently impaired by scrofulous affections of the cervical and thoracic glands, and especially of the bronchial glands. The phenomena dependent upon this morbid affection accompany the phthisis bronchialis that prevails in early life, to a greater or less extent. They may be summed up as follows: Attacks of dyspnœa induced by the least exertion, and almost amounting to suffocation when attempts at deep inspiration are made, noisy hissing respiration, a whispering, rough, hoarse voice; paroxysms of cough resembling tussis convulsiva by their metallic, shrill sound, mucous râles in the lungs, often audible at a considerable distance from the thorax, without any sense of repletion of the bronchi. These paroxysms come and go, according to the greater or less want of air felt by the patient; they generally are associated with other symptoms which depend upon the pressure exerted by the swollen glands upon the blood-vessels, such as œdema, a pale, almost livid complexion, or upon tubercular deposit in other organs, and especially in the lungs. At the post-mortem investigation we find both the trunk of the vagus and its branches, the recurrent and the pulmonary nerves, encircled by the degenerated glandular mass, compressed, flattened, thin, transparent, atrophic, or so entirely fused with the mass, that it becomes impossible to trace the nervous fibres. Wrisberg[1] was the first to mention the occurrence of this condition in a scrofulous boy; "Some of the bronchial glands," he says, "were converted into very hard bodies, and surrounded the eighth nerve, where it descends into the right side of the thorax, and is about to send off the recurrent, in such a manner that I found it impossible to separate it from the mass. The same happened to the phrenic of the same side. At the division of the bronchi, there was a tracheal gland of almost stony hardness; not even a trace of the pulmonic plexuses derived from the eighth nerve were to be found passing through these osseous concretions." Since the time of Wrisberg, Becker,[2] and especially Hugh Ley, have established the character of these conditions, both by their descriptions and their delineations. Among several cases which have fallen under my observation, one of which I have already communicated, there was one of peculiar interest which occurred in a girl of five years, who was idiotic, unable to speak, and much retarded in her growth, and whose lower extremities were paralysed. Her cranium was small, the anterior and posterior fontanelles were open, the thorax compressed at the sides, the abdomen very prominent, and the limbs rickety. For two months past she had almost entirely lost her voice; and a crowing cough in short fits and accompanied by extreme dyspnœa, had supervened. Her breathing was noisy and hissing, as if there were a mechanical impediment in the larynx. The sound of the left side of the thorax was dull on percussion. In the greater part of the right lung no vesicular breathing was heard. A remission of the symptoms was ascribed to the remedies employed, but they soon returned with additional force, violent hectic fever supervened, and death ensued from suffocation. The post-mortem which took place on the 13th December, 1841, showed a conglomeration of tumid bronchial glands in the vicinity of the bifurcation of the trachea, of an oval shape, an inch and a half long and an inch broad; they pressed upon the trachea anteriorly, superiorly upon the right bronchus, and upon the vagus of the same side, the corresponding recurrent being so firmly adherent to the tumour that they could not be separated. At the posterior surface at the bifurcation of the trachea, was a heart-shaped indurated bronchial gland of the size of a hazel-nut. On dividing it, tubercular matter was found imbedded in the hypertrophied gland tissue, and in some parts the former was softened. The larynx and trachea were normal, excepting a considerable reddening of the mucous membrane in the vicinity of the bifurcation and in the bronchi. The right lung was filled with crude and softened tubercles, and in its centre was an excavation of the size of a plum. In the left lung there were only a few tubercles, as well as on the surface of the liver and in the parenchyma of the spleen. The mesenteric glands were hypertrophied and tubercular. The mesenteric glands were unusually thin and full of blood; the volume of the brain was very small, its consistency was firmer than usual. The lateral ventricles and the third ventricle were dilated, and filled with serous fluid to the amount of about four ounces. A tubercle of the size of a pea was found at the posterior end of the right corpus striatum. The dimensions of the skull were all very much reduced, and the foramen magnum especially so.[1]

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[1] Commentationes Medici Argumenti; Götting. 1800, vol. i, p. 144.

[2] De Glandulis Thoracis Lymphaticis atque Thymo, Specimen Pathologicum. Berolini, 1826.

We generally find the vagus of one side only affected by tumefied and indurated glands; or if both are involved, one is more implicated than the other. The younger the individuals, the more imminent the danger from the suffocative attacks; in the same way we see that asphyxia occurs the more rapidly in animals the earlier the period of life at which the vagus is divided. Several corroborative cases are adduced by Ley,[2] and one instance of this kind has been accurately described by Mr. Günther[3] as having occurred in his own child, an infant of eight months. One of the attacks of asphyxia which this child passed through had the longest duration of any that ever came to my notice; the circumstance is thus related: the child had drunk several times during the night, and had then again quietly gone to sleep; suddenly it emitted a short piercing scream and ceased to breathe. The mother flew to its assistance, but the child was rigid and did not show the slightest trace of life. The next moment the father was at the bedside, and found the child lifeless, no limb moved, not the slightest respiratory effort was perceptible. The pale face was dreadfully disfigured, the eyes expanded and distorted, the tongue was protruded, the entire body was almost cold, and the heart and the pulse had ceased to beat. The head was washed with naphtha: spirits of ammonia were rubbed into the scrobiculus cordis, the abdomen, the feet, and the back, and vigorous friction was made with hot woollen cloths. These attempts to restore life were continued from twenty to twenty-five minutes uninterruptedly, when the muscles, which were all extremely rigid, relaxed, a croaking expiration took place, and at last the child began to scream loudly, though for some time with a groan. Subsequently the asphyctic attacks gave way to a cough, which occurred in paroxysms, and resembled hooping cough, a viscid white mucus filling the mouth, was expectorated with jerking expiratory efforts. These paroxysms of cough became fewer; mucous rattles, and a true phthisical cough, with much thick mucous expectoration, supervened; the child became more and more exhausted, until death closed the scene. The thymus was normal. A tumour of the size of a walnut lay upon the right vagus, obliquely opposite to and rather below the thymus, at the point where, at the external side of the vagus, the lowest cervical ganglion of the sympathetic lies. This large hard tumour, which was evidently a degenerated bronchial gland, surrounded the vagus in such wise, that the trunk of the nerve and the inferior laryngeal passed through the posterior part of the tumour, and required to be dissected out of the somewhat loose cellular tissue, which could not be done completely without injuring the sheath of the nerve. In both lungs there were a number of tubercles and several excavations, the mesenteric glands were swollen, and the surface of the spleen was covered with numerous small tubercles.

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[1] The reader is referred to Romberg's Klinische Ergebnisse, for the details of other cases.

[2] Loc. cit., pp. 39, 40, 139.

[3] Schmidt's Jahrbücher, vol. xxv, 1840, p. 60.

Although infancy is peculiarly prone to scrofulous affections of the cervical and bronchial glands, the pressure of which interferes with the conducting power of the vagus, the later periods of life are not exempt. Andral[1] describes an instructive case of the kind: the patient, a man aged 24, for some time affected with painful lymphatic tumours on both sides of his neck, suffered from paroxysms which indicated an organic affection of the heart; the face was swollen and livid, the lips and alæ nasi were blueish, the eyelids were œdematous, there was ascites, and short accelerated respiration, during which the movements were almost confined to the ribs; the patient could not lie down owing to imminent suffocation, and he maintained a semi-erect posture in bed, with his head and trunk well supported. For a year past the dyspnœa had been on the increase, but it was augmented still more in damp, rainy weather. The percussion of the entire chest was sonorous. At some parts mucous bubbling, at others sibilant noises were heard, but throughout there was a strong normal respiratory murmur. Whenever the patient attempted to leave his bed respiration became laboured. Death ensued during a violent attack of orthopnœa. At the post-mortem the heart and lungs, excepting a few miliary tubercles in the latter, proved to be healthy. A considerable number of tuberculated lymphatic glands were found in the anterior mediastinum; and the two phrenic nerves passed through them, being so encircled and compressed, that they could not be distinctly traced within the mass. From the point of exit to their distribution in the diaphragm, they presented a grey hue. At both sides of the neck, from the edge of the lower jaw to the clavicle, a considerable heap of tuberculated glands was found, several of which lay between the vessels and nerves of the neck. A few inches below the point at which the superior laryngeal nerve was given off, the vagi disappeared in these masses, from which they were only disengaged immediately above the clavicle, much flattened. The peritoneal cavity contained a quantity of serous fluid. A mass of tuberculated glands lay before the spinal column, which on one side compressed the vena cava, on the other the vena porta.

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[1] Clinique Médicale, 3me édit. vol. iii, p. 263.

Besides the glands the large arteries within the thoracic cavity and in the neck, the arch of the aorta on the left, and the anonyma and subclavian artery on the right side, may, when affected with aneurism, compress the vagus, and more particularly the recurrent branch. In this case symptoms would result which might erroneously be attributed to a compression of the windpipe, viz. attacks of dyspnœa, amounting almost to suffocation, and increased by movement, paroxysms of coughing, with mucous or sibilant râles.[1] In this way aneurisms occasionally induce the fatal termination suddenly, without rupture or occlusion of the trachea having taken place.[2] Tumours of the thymus rarely,[3] and those of the thyroid still less frequently, give rise to compression of the vagus or recurrent branch. Morbid growths in the vicinity of the trachea or the thoracic cavity, occasionally exert this effect. A case of this description has been published by Montault;[4] the patient suffered from constipation, sickness, and vomiting, while the tongue remained clean; he was pale and sleepless, had a variable pulse, frequent cough, with a croupy sound, and mucous bubbling throughout the thorax; and suffered from suffocative fits. At the post-mortem an encephaloid tumour was found to proceed from the bronchial glands, one portion of which compressed the cardiac nerves between the pulmonary artery and the arch of the aorta; another the right recurrent; a third was fused into a mass with the left recurrent; and a fourth rested upon the anterior portion of the trachea. Becker communicates a case in his Treatise, in which the tumour had given rise to atrophy of the right vagus, so that it looked rather like a membrane than a nerve. In Hasler's 'Dissertatio Inauguralis de Neuromate,' (Turici, 1835,) we find a case described which occurred in the practice of Professor Schönbein; a female, aged 20, fell into the water while much heated, and was in consequence attacked by paraplegia. At the right side of the neck a tumour, which was freely moveable, projected under the sterno-cleido-mastoid muscle. During the illness, which lasted five months, a violent asthmatic attack recurred four times a day, accompanied by an overpowering sense of anxiety; tumultuous movement of the thoracic and abdominal muscles; palpitation of the heart; icy coldness of the extremities; speechlessness, with undisturbed intellect, and a livid complexion. Death carried the patient off during one of these attacks. On the right side, a neuroma of the first cervical ganglion of the sympathetic, 4 inches 2 lines long by 5 inches broad, presented itself, compressing the vagus, which presented several tumefactions in its course. At the upper part of the spinal cord, and under the cerebellum, there were several tumours resembling in structure the neuroma of the sympathetic.

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[1] See a few Cases by Graham and Alison, in—Edinburgh Medical and Surgical Journal, April, 1835; Cruveilhier, Anat. Pathol., livr. iii, pl. iii.

[2] See Lawrence; in Med.-Chir. Trans., vol. vi, p. 227.

[3] Hugh Ley; loc. cit., p. 469.

[4] Journal Univers. et Hebdom. de Médecine, &c., vol. ii, p. 73.

It is not to be forgotten, however, that tumours occur in the vicinity of the vagus, without in any way impairing its functions; the less impediment they meet with in their advance, the less pressure there will be upon the nerve; for this reason large, prominent tumours of the neck, are rarely accompanied by paralytic symptoms, while they are caused by smaller tumours which lie more deeply, and are exposed to the contractions of adjoining muscles. The functions of the vagus are scarcely affected when it passes over the tumour; for a gradual distension of the nerve fibres, unless an inflammatory or softening process exists, neither disturbs the sensory nor the motor energy, as my own experiments and those of other inquirers have demonstrated. But even if the conduction of the vagus is arrested, respiration can continue as long as no great respiratory effort is required. For in quiet breathing the movements of the glottis, as Le Gallois was the first to describe, are almost imperceptible. The vocal cords enclose, as Mayo's observations upon suicides have shown, a triangular opening; it is only when deep inspirations are made, and the breathing becomes laboured, that the pressure of the atmosphere closes the edges of the glottis, and prevents the entrance of the air, when the muscles that open the chink have lost their motor power. This explains the paroxysmal character of the dyspnœa, and the imminent suffocation, although the compression is permanent.

Comparative pathology affords an instructive illustration of the subject under consideration, in a disease not unfrequently occurring in horses, the characteristic symptoms of which are the following: When the animal is standing at rest, breathing is undisturbed and noiseless; the number of respirations are the same as in the healthy animal, the pulse is normal, and the conjunctiva as well as the mucous membrane of the mouth and nares are pale and moist. When the animal moves respiration is at once accelerated and impeded; inspiration is loud, harsh, and rattling, on which account the disease has been termed roaring. Perspiration breaks out over the whole body; there is an anxious look; the mucous membrane of the nose is reddened; the horse is only able to move slowly and laboriously. If it is allowed to stand still for a time, the dyspnœa and the noisy respiration at once cease, and all the functions return to the normal condition. But if such horses are forced into violent exertion, made to gallop, or to drag a heavy cart, their respiration becomes more laboured and louder, so that they can be heard at a considerable distance; the number of their respirations increases six and eight fold; the pulse becomes very quick, small, intermittent; the nostrils are widely dilated; the mouth is open; the eyes stare; the horse totters and trembles, and if forced to go on, it breaks down in a suffocative condition. Death appears to be close at hand; but even now, if allowed rest, the animal again becomes unembarrassed; the other functions very rarely suffer, the appetite is good, the excretions are regular, nutrition is unimpaired. A few important symptoms are discovered on exploration, which may in future be partly used for diagnosis in man. The paralysed side of the larynx may be more easily pressed inwards than the healthy side; the disease, it may be observed, almost always occurs on one side only; it is generally on the left, and but exceptionally on the right side. If we press the left arytenoid cartilages with a certain force, and for several minutes, while the larynx is fixed on the right side and below, we are able to produce the same difficult and noisy respiration as we find resulting from exercise. If we exert the same pressure on the right cartilage these attacks do not take place; but if the arytenoid cartilage of the healthy side is compressed so firmly that it is placed as if the glottis were closed, respiration is at once arrested, because its fellow, owing to the paralysis of the muscles, is unable to raise itself.

If the hand is introduced into the pharynx down to the larynx, we find the glottis placed obliquely to the right, and the right fold is tense, while the left one is relaxed. When such horses are examined after death, morbid charges are found in the vagus, before it gives off the recurrent, or in the recurrent of the paralysed side only. Dupuytren[1] found these nerves compressed by swollen and hardened lymphatic glands, and morbid growths. Günther,[2] who has the merit of being the first to describe this disease accurately and well, found the recurrent nerve of the left side in six cases much atrophied and dried, without any compressing cause, while the nerve of the right side was perfectly normal; at the same time, all the muscles supplied by the recurrent, and destined to open the glottis, the crico-arytenoideus posticus, the crico-arytenoideus lateralis, the thyro-arytenoideus, superior and inferior, and the left half of the arytenoideus transversus, were found very much atrophied, pale, and flabby. These observations have been confirmed by the Professors of the Veterinary School at Berlin, Gurlt, and Hertwig.[3] It is not long since, Gurlt showed us a preparation in the veterinary museum, in which the recurrent, to the extent of about an inch and a half, is atrophied, half the thickness of the one of the right side, and not of a pure white, but of a dirty grey colour. The muscles just named have almost entirely disappeared, and are converted into fatty tissue. Percivall states, in the 'Veterinarian' for 1840, that Field produced respiratory paralysis artificially, by cutting a piece an inch and a half long out of the right recurrent; that he kept the horse alive for four years, and at the post-mortem found all the muscles dependent upon the recurrent atrophied in an extreme degree. This disease has been observed by Trousseau to be caused by lead poisoning in horses, who worked in a minium manufactory.[4] Dupuytren attributes it to epidemic and miasmatic influences; others to the consumption of a plant much cultivated in the south of France, the latyrus ciceræ;[5] and Günther is of opinion that it is owing to a metastatic process occurring in the epizootic nervous fever of horses. It is only in recent cases of the kind, that derivative treatment by means of setons, issues, cantharides, and tartrate of antimony ointment, are likely to prove serviceable; the horse should at the same time be placed in the most favorable circumstances as regards air and diet. After the disease has existed for some time, or if the causes are not to be removed, a radical cure is impossible. The operation of tracheotomy is a palliative proceeding, by which the horse may be kept alive for years, provided the orifice be kept open afterwards.

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[1] Journal Général de Médecine, Avril, 1821.

[2] Untersuchungen über den Pfeiferdampf oder die sogenannte Hartschnaufigkeit der Pferde, in—Zeitschrift für die gesammte Thierheilkunde und Viehzucht, vol. i, p. 267.

[3] See the Treatise and Plate by Hertwig, in the—Magazin für die gesammte Thierheilkunde, 1841, No. 1, p. 98.

[4] Froriep's Notizen, 1827, No. 378.

[5] Renault, in the Veterinarian, vol. viii, p. 32.

There are a few more symptoms to which we must briefly allude; one is the alteration of the voice, from a rough coarse sound to complete aphonia, of which almost all authors have spoken; there is another which requires to be yet further investigated, it is the anæsthesia of the trachea. Even during health the sensibility of the trachea varies; it is most marked at the glottis and in the larynx, which parts are supplied by the laryngeal nerve; the terminal branches of which are very rarely involved in glandular tumours or other morbid influences; for this reason the sensibility at the entrance of the windpipe, which serves to protect the entire respiratory apparatus, continues unimpaired. The outlet of the trachea, the bronchi, are endowed with a lower degree of sensibility; they are capable of conveying an impression of repletion when charged with mucus and other fluids. When the vagus and the pulmonary branches given off by it, are compressed by bronchial glands, this is not the case; mucous rattling is heard at a considerable distance, while the patient experiences no inconvenience. The trachea is least sensitive of all these parts, as proved by the notorious manipulations in tracheotomy, the brushing and cauterisation of the trachea, recommended by Trousseau in croup. As to the consecutive changes that take place in the parenchyma of the lungs when the vagus is paralysed, too few careful observations have been made on the subject in man to state anything positively on the subject. The repletion of the vessels, the congestion, and the accumulation of exuded matters, are generally considered as symptoms of bronchitis; and the vesicular emphysema and the dilatation of the bronchi, which are found complicated with scrofulous affections of the bronchial glands after hooping cough, are treated as sequelæ of this affection. But the dilatation of the pulmonary vesicles and the bronchi themselves may probably be more justly considered as a result of paralysis of their contractile parietes.[1]

II. PARALYSIS OF THE CENTRAL PORTION OF THE VAGUS.

Lesions and diseases of the medulla oblongata arrest the respiratory functions of the vagus. The sudden death resulting from pressure, bruising or laceration of the medulla oblongata, caused by luxation and fracture of the first two cervical vertebræ, are well known in the annals of surgery. Hæmorrhage into the medulla oblongata, of which Ollivier[2] has communicated a few instances, is followed by similar consequences; the asphyxia of new-born infants is often due to extravasation of blood upon the external surface of the cerebellum, the medulla oblongata, and the spinal cord.[3] Chronic compression of the medulla oblongata by aneurismatic and other tumours, is accompanied by paralytic affections of the muscles of respiration; a case is detailed in Ollivier's work,[4] in which the pyramids were destroyed, and the points of insertion of the vagus, glosso-pharyngeus and hypoglossus, were compressed by an aneurism of the basilar arteries. There was dyspnœa amounting to suffocation, aphonia and difficult articulation, combined with paralysis of the extremities. Disease of the bones may paralyse the motor energy of the vagus, as it does the sensory powers, by the pressure, &c., being propagated to the origin of the vagus; symptoms of this kind are associated with every death proceeding from the brain.

We can only expect any good result from treatment in the peripheral paralyses of the vagus, when there is a possibility of getting rid of the cause, and if the structure of the nerve has not become impaired. When we have to do with scrofulous affections of the cervical and bronchial glands, cod liver oil, the preparations of iodine, country air, sea and salt baths are indicated. When there is disease of the upper cervical vertebræ, a spontaneous cure sometimes, though rarely, takes place, and it may be promoted by issues.

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[1] Consult Henle's Abhandlung über Tonus, Krampf und Lähmung der Bronchen und über Expectoration, in—Zeitschrift für rationelle Medecin, vol. i, p. 271.

[2] Traité des Maladies de la Moëlle Epinière, 3d edit., vol. ii, p. 139.

[3] Cruveilhier; Anat. Pathol. du Corps Humain, livr. xv, pl. i.

[4] Vol. i, pp. 455—464.

CHAPTER XL.

PARALYSIS OF THE SPINAL NERVES SUPPLYING THE RESPIRATORY MUSCLES OF THE TRUNK.

THE oldest neurophysiological experiments on living animals relate to this form of paralysis; Galen[1] divided the cervical and dorsal portions of the spinal cord at different points, in order to show his pupils the paralysing influence thus exerted upon the intercostal muscles and the diaphragm. The later experiments of Le Gallois, Flourens, and others, only differ from these by being executed with greater precision; the merit of having instituted experiments upon the peripheral distribution of these nerves belongs to that incomparable man, Sir Charles Bell,[2] who selected the phrenic and accessory nerves for this purpose.

The paralytic affections of the spinal nerves supplying the respiratory muscles of the trunk, are distinguished from similar conditions of the vagus by the extreme rarity with which they are caused by morbid states of the peripheral distributions; they are almost invariably due to an affection of the central organ. The conduction is interrupted in the spinal cord; either the cerebral or the reflex conduction, or both together, being arrested. The latter is most frequently the cause when lesions, and especially fractures of the vertebræ, have taken place; these, like experiments upon living animals, which are certainly the most distressing that we can perform, afford uncomplicated results, whereas in diseases the accuracy of the phenomena is always more or less clouded by the complications that are present. The parts of the respiratory organs paralysed under these circumstances, correspond to the height at which the lesion has been inflicted; if the injury is inflicted above the insertion of the phrenic nerves, death generally ensues too rapidly to allow of any observation being made. Bell[1] describes a soldier who was wounded in this manner and survived half an hour. The movements of respiration were only effected by the muscles of the neck and shoulders; at every inspiration the head was drawn down between the shoulders. The diaphragm did not move; when the hand was laid upon the scrobiculus cordis, no movement was perceived in the abdominal viscera. If the lesion has taken place lower down, in the vicinity of the lower cervical or upper thoracic vertebræ, the intercostal muscles and the expiratory abdominal muscles lose their motor power, whereas the expanding muscles of inspiration (the diaphragm, the serratus anticus, the sterno-cleido-mastoideus, the trapezius,) continue in the possession of this function. Inspiration takes place in short quick snatches, during which the contractions of the serratus may be distinctly felt if the fingers are spread out on the thorax. Expiration and every movement connected with it is incomplete, as it is not effected by muscular contraction, but by the elasticity of the ribs and the abdominal parietes, as well as by the pressure of the abdominal viscera against the lower surface of the relaxed diaphragm. This is the cause of the inability to cough or expectorate, to speak loudly, to sneeze, to blow the nose, or to strain, and of the increase of the dyspnœa in the erect, sitting posture, because this prevents the pressure of the abdominal viscera against the diaphragm. Similar phenomena are sometimes met with in inflammation of the cervical vertebræ, they continue while the disease lasts and cease with it;[2] whereas, in fractures of the cervical vertebræ, life rarely continues beyond the sixth day, and is generally extinct a few days after the injury. In rare cases paralysis of the respiratory muscles of the trunk supervenes upon paralysis of the superior extremities in lead poisoning; the thoracic parietes are much sunk, and death ensues from asphyxia.[3]

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[1] De Anatomes Administrationibus, lib. viii, cap. ix.

[2] The Nervous System, &c., 3d ed., p. 115.

The isolated loss of cerebral conduction, or of spinal reflex conduction in the nerves of the respiratory muscles, becomes very perceptible in morbid conditions. In the former case there is an inability to execute voluntary movements with the same muscles, while they are capable of executing their respiratory functions, *e. g.*, the muscles that move the scapula. A person affected with hemiplegia resulting from cerebral disorganisation, is unable to raise the shoulder on the paralysed side at will, to depress it or to approach it to the vertebral column; on the other hand, when the respiration is hurried, if the diaphragm is compressed or the nostrils are closed, no difference is perceived in the rise or fall of the shoulder blades.

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[1] Loc. cit., p. 124.

[2] Bell, loc. cit.; and Bright, in Guy's Hospital Reports, vol. ii, p. 296.

[3] Tanquerel des Planches; Traité des Maladies de Plomb, vol. ii, pp. 61, 130, 140.

When the spinal conduction is impaired, one or more muscles refuse to co-operate in respiration, but obey the influence of the will. An increase in the want of respiration, produced by compression of the abdomen, gives distinct evidence of the respiratory inactivity of the muscles, in consequence of which the form and expansion of the thorax, which depend upon the tone and the respiratory vigour of these muscles, undergo an alteration. Stromeyer's investigations and experiments were the first to give any information on this subject.[1] He excised a portion of the posterior thoracic nerve in a young rabbit, as high as possible, and even three days after a marked diminution was observed in the corresponding half of the thorax. This increased daily, so that a fortnight later it was shown by measurement that there was a difference amounting to five or six lines. The experiment was repeated on another rabbit with the same result. In man the serrati antici, which are supplied by this nerve, are the main seat of immobility, in which other muscles, and especially the trapezius, participate as the disease progresses. The phenomena vary according to the greater or less resiliency of the osseous structures, or according as one or both sides are affected. In infancy, and even in youth, the vertebral column becomes distorted, the vertebræ following the traction exerted by the muscles of the healthy side; they do so the more rapidly the younger the child is.

If the disease lasts any length of time, and affects only one side, it is thus that scoliosis results. The shoulders have an unequal height; one scapula is lower than the other; and its inferior angle, which normally abuts on the eighth rib, is found below the level of the tenth rib. The dorsal vertebræ are slightly rotated on their axis, and form a lateral curvature, the concave edge of which is directed towards the depressed shoulder. The corresponding anterior half of the thorax has sunk, being drawn inwards and downwards by the diaphragm, and does not respire, a fact of which it is easy to convince one's self, if the muscles of inspiration are advisedly excited to increased action. The voluntary movements take place, although the scapula retains its oblique direction to the vertebral column, and the sunken side of the thorax does not rise as perfectly as its fellow. If the respiratory muscles of both halves of the thorax are the seat of the disease, we shall find the thorax flattened at the sides, and in early childhood we not unfrequently find the sternum and the bent costal cartilages strongly projecting, giving rise to the so-called chicken-breast, or pectus carinatum. The inferior margin of the thorax is in this case also drawn in, causing the abdomen to appear more voluminous and distended. In such cases the breathing becomes laborious, and is rendered still more so by movement or exertion. Occasionally the disease first appears in this shape; and subsequently, when the muscles of one thoracic half have recovered their activity, is converted into paralytic scoliosis. If the affection lasts a long time, the muscles become atrophied.

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[1] Ueber Paralyse der Inspirations Muskeln, in—Casper's Wochenschrift, 1837 p. 51.

In advanced life the secondary change of form does not take the shape of scoliosis and chicken-breast, but owing to the paralysis being confined to the serratus anticus, is limited to a change in the position of the scapula, which stands off from the vertebral column and the ribs, and assumes a direction outwards and forwards. The patient is no longer able to raise the arm with the same facility as previously. In rare cases, a contraction occurs at the same time with an elongation of the thorax, and it is a matter of peculiar interest that the disease often presents itself in paroxysms. A case of this kind, observed by Shaw, has been communicated by Stromeyer:[1] the patient, a man of 28 years, of robust athletic conformation, complained that he was unable to expand his chest freely in breathing. On examination, it proved that the ribs, and especially the inferior ones, were drawn in and peculiarly distorted, compressing the thorax like a bandage, and causing a rotundity of the abdomen like that of old people. The thorax retained this shape both in inspiration and expiration; if the patient took a deep breath, the ribs remained immoveable and no expansion or elevation of the thorax whatever was visible, and the patient at the same time experienced a pain in the chest. Every inspiration was accompanied by a peculiar grunting noise in the stomach and intestines; all the external muscles of the thorax and shoulders, which aid the diaphragm in respiration, remained inactive notwithstanding the efforts of the patient, whereas during expiration the abdominal muscles were felt to contract vigorously, if the hand was placed upon the abdomen. If pressure was applied with some force, it arrested respiration. When he sneezed he felt a pain as if the chest would burst. He was unable to move rapidly and to go up stairs; his dreams were heavy, and he often woke up half-strangled. The muscles of the neck and thorax, which were inactive in breathing, retained their usual energy for all other movements, such as raising or bending the head or the shoulders. The disease occurred in distinct paroxysms, continuing for a fortnight at a time; at the time of observation the patient was suffering from his fifteenth attack. In the interval the chest expanded well, and presented the normal capacity, nor was the abdomen so much distended. The first attack came on in consequence of the patient's galloping over a dyke, while convalescent from a violent inflammation of the abdomen by which he had been much reduced. The paroxysms generally returned when he approached the sea-coast, and disappeared when he removed inland. The patient was first purged with calomel and colocynth given three times a week; after this he was treated with a tonic containing muriatic acid, frictions of the thorax with a hot solution of muriate of ammonia, and a cataplasm of belladonna. In twenty days he was completely restored. The following are the measurements taken at two different periods:

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[1] Loc. cit., p. 26.

28*th October*.—Circumference of thorax round the xyphoid-process, 28¼ inches.

10*th November*.—33¼ inches; difference 5 inches. Circumference of thorax above the nipples, on the first occasion, 31½ inches; the second time, 34¼ inches; difference, 2¾ inches.

In hysterical subjects I have found dyspnœa caused by similar circumstances; they appeared to me to form a contrast with the dyspnœa of pulmonary emphysema; in the latter there is a contradiction between the violent efforts of all the muscles of inspiration and the incapability of filling cells already distended with fresh air; in the former the air enters without any impediment into all the channels, while the muscles that expand the chest cease to co-operate to that end. Physicians have hitherto only directed their attention to the heart and lungs in cases of dyspnœa: they will, in many cases, be likely to obtain valuable information by attending to the movements of the thorax.

The most fertile sources of the present affection are: the predisposition afforded by infancy and by the female sex, especially during the period of puberty; rhachitis, anæmia, debilitating influences, hooping-cough, and derangement of the catamenia.

In selecting our treatment, we must first attend to the cause, and then seek to augment the voluntary conduction in the nerves of the muscles that have become inactive in respiration. This indication is best fulfilled by gymnastic exercises, and especially by suspending the body by the hands, by which means we induce an action in the serratus magnus. Gymnastics in themselves stimulate and invigorate the muscles of respiration, as shown by the increase in the circumference of the thorax which takes place after a few minutes.[1] Swimming is likewise much to be recommended; we must also try to restore the reflex action by exciting the sensory nerves; this may be done by frictions with a solution of liquor ammoniæ in alcohol (℥j to ℥vij), or the mistura oleoso balsamica,[2] by shampooing, the douche, electricity, sea or salt baths.

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[1] Stromeyer; loc. cit., p. 312.

[2] [Sive Balsamus vitæ Hofmanni. See Note, vol. i, p. 106.]—Ed.

CHAPTER XLI.

PARALYSIS OF THE VOCAL NERVES.

ALTHOUGH the voice is formed by the vibrations of the cordæ vocales in the larynx, the surrounding parts, through which the air passes, exert an essential influence upon the modification of the sounds. The prefixed tube of the larynx (Ansatzrohr), as Müller[1] terms the space between the cordæ vocales and the mouth and nares, exerts the chief influence in this respect. In the living subject the tension necessary for the production of sound is effected by muscular action, and the range of the motor nerves by which it is controlled is much more extensive than is generally admitted. Though the recurrent nerve plays the most important part in reference to the larynx, yet it does not monopolise the direction of the voice in the manner attributed to it by Galen. Experiments have proved that after division of both recurrent laryngeal nerves in animals, they are still, under the influence of pain, able to utter a cry; and Longet[2] has shown that it is the external branch of the laryngeus superior supplying the cricothyroid muscle which, in this case, is called into action; and, on the other, if this nerve is divided while the recurrent nerve remains entire, the voice becomes hoarse. Besides the nerve just mentioned, the motor nerves of the velum palati, the arches of the palate and the tongue deserve a consideration; they have hitherto been overlooked in paralytic affections of the voice; the little attention they have met with is due, in a great measure, to pathologists having attended to the action of the voice in connection with speech only, instead of viewing it also in relation to singing. Joseph Frank,[3] and especially the late Dr. Bennati,[4] have the merit of being the first to direct attention to the latter point. Dr. Bennati, himself a distinguished singer, had numerous opportunities of making experiments on the subject from being professionally connected with the opera in Paris.

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[1] Elements of Physiology, transl. by Dr. Baly, vol. ii, p. 988.

[2] Recherches Expérimentales sur les Fonctions des Nerfs des Muscles du Larynx et sur l'Influence du Nerf accessoire de Willis dans la Phonation; Paris, 1841, p. 8.

[3] Praxeos Medic. Univers. Præcepta, vol. ii, p. 43; Lipsiæ, 1823.

[4] Etudes Physiologiques et Pathologiques sur les Organes de la Voix Humaine; Paris, 1833.

The loss of the voice is either partial or complete. In the former case, the patient is unable to sound his voice to its usual full compass; of this he will be best able to speak himself, if conversant with music; the high falsetto notes are generally affected. But not unfrequently the tone of the other notes is less clear and pure than in health, and the voice is unable to hold a note. On examining the fauces, the inner mucous membrane is found pale and relaxed; the movements of the velum and the uvula are indolent and imperfect. The upward and downward movements of the larynx are also impeded, as Joseph Frank noticed. In complete aphonia, there is an utter inability to sound articulate or inarticulate notes, and the individual can utter nothing above a whisper.

The causes are either peripheral or central. Among the former, we may enumerate injuries and operations about the neck implicating the recurrent nerve, tumours which compress it, especially aneurisms of the aorta, or the subclavian artery, tumefied bronchial glands, if they involve the nerves of one side only, hyperstimulation of the vocal nerves by undue exertion, singing, screaming, and continued loud speaking, rheumatic influences, such as a cold draught impinging upon the exposed or heated neck. Centric affections are more frequently seated in the upper part of the spinal cord than in the brain; they are lesions, diseases of the vertebræ, chronic myelitis, poisoning by narcotics (hyoscyamus, belladonna, stramonium,) and lead poisoning;[1] in the last case the aphonia is rarely isolated, but generally associated with other paralytic diseases, especially of the movements of articulation. Among the cerebral causes we have to mention violent affections of the mind, especially pain and epilepsy. The most frequent cause of aphonia, however, is reflex immobility. The uterine system exerts a marked influence, as the change in the character of the voice during the catamenial period sufficiently demonstrates. Amenorrhœa and hysteria are the conditions which favour it more particularly; for this reason the greatest number of patients suffering from aphonia are found to be females. The relation of the gastro-intestinal tract to the affection is shown in helminthiasis and cholera. In Asiatic cholera the voice is occasionally altogether lost, and is associated with anæsthesia of the trachea.

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[1] Tanquerel des Planches; loc. cit., vol. ii, p. 62.

The affection generally runs a chronic course; it may last a year and more. When the aphonia is of the reflex character, the voice occasionally returns under the influence of powerful excitement, and again disappears, a fact that I have also frequently observed in Asiatic cholera. In treating the complaint errors are frequently committed owing to an assumption of an inflammatory element, and more particularly in the repeated employment of local abstraction of blood and the prohibition not to speak. The absence of cough, and of a coarse harsh respiratory murmur on auscultating the larynx, may serve as diagnostic criteria. The first thing we have to do is to fulfil the etiological indications. If this proceeding is ineffectual, or if we are unable to ascertain a cause, we must act upon the vagus; firstly, in the vicinity of its centric origin, by cupping in the neck, blisters with the endermic application of strychnine, the cold douche, and moxæ; the latter are also useful in determining whether the aphonia has been simulated, which it sometimes is for various purposes. Secondly, in its peripheral distribution; it is here that electricity and magnetism, and most recently electro-magnetism, have proved of greatest value. Thirdly, by means of reflex action through the stimulation of sensory nerves. Everybody recommends cutaneous counter-irritation; I have obtained most benefit by friction with croton oil; others praise the internal and external application of cajaput oil. Fourthly, by translation to the gastric tract of the vagus. Emetics have obtained a reputation in aphonia from an early period. Nauseating remedies are also useful in these cases; Bennati recommends a gargle composed of a solution of alum and decoctum hordei (ʒij—ʒv to ℥viij—℥x) for the aphonia caused by over-exertion of the voice.

CHAPTER XLII.

PARALYSIS IN THE MUSCULAR RANGE OF THE SYMPATHETIC.

The correct way to appreciate these paralytic affections was long since indicated by De Haen, who based his researches upon the excellent anatomical investigations of Petit (1726) and Winslow. He says in his 'Ratio Medendi'[1] the intercostal nerve does not therefore take its origin "from the common source of the nerves, the medulla oblongata, (which we used to consider as its origin within the skull, the nerve being rather an ascending branch that enters the cranium, than one descending to the trunk;) but it arises in the neck, the chest, and the abdomen, from those wonderful bodies termed ganglia; bodies which arise from the nerves, commingle the nerves, and give rise to new nerves." De Haen, however, found no one to follow him. On the other hand, Bichat's and subsequently Reil's hypotheses about the sympathetic met with an enthusiastic reception at the commencement of the present century, and physicians of easy faith, and even Mesmer's pupils, availed themselves of it to a degree almost amounting to insanity. The sympathetic became the scapegoat of ignorance. Modern physiology again restored the nerve to its rights, and it is only in the most recent times that its independent character has been established both in its anatomical and physiological relations.[2] Its ganglia and the nerve fibres[3] arising within them from a portion of the ganglionic corpuscles, secure its independence; the ganglia are central organs from which both the immediate and the reflected stimulation of the motor nerves proceeds. Henle's observation, which has been confirmed by Kölliker's experiments upon animals, affords positive evidence; they find that separate portions of intestine, so long as they remain in connection with the mesentery, and therefore with many ganglia, execute extensive movements when irritated, whereas they only contract locally when the mesenteric connection has been severed. Toxicological observations equally demonstrate the independence of the sympathetic. Poisoning with tobacco and arsenic paralyses the cardiac nerves and arrests the circulation, while the respiratory movements continue. The East Indian poison, upas antiar, which contains strychnine, acts similarly. On the other hand, the West Indian arrow poison, called urali, wurali, or woorara, the operative principle of which Robert Schomburgk's[1] investigations in Guiana have shown to be obtained from the strychnos toxifera, paralyses the respiratory and voluntary movements, at the same time that the action of the heart continues, and may be kept up by artificial respiration. This subject has already been elucidated by Brodie's accurate experiments, from which it appears that the poisons do not operate uniformly in the different classes of animals; thus, in the dog the effect of arsenic is greater upon the heart than upon the brain, while the reverse takes place in the rabbit.

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[1] Vol. iii, p. 104.

[2] See—Bidder und Volkmann, die Selbstständigkeit des Sympathischen Nervensystems, durch anatomische Untersuchungen nachgewiesen, Leipzig, 1842; Bidder, Erfahrungen über die functionelle Selbstständigkeit des Sympathischen Nervensystems, in—Müller's Archiv, 1844, p. 359; Kölliker, die Selbständigkeit und Abhängigkeit des Sympathischen Nervensystems durch Anatomische Beobachtungen bewiesen; Zürich, 1845.

[3] Kölliker; loc. cit., p. 28.

Now these ganglia are also a source of spasms and paralysis of the so-called involuntary muscles, both of a primary and of a reflex character. Observations upon human beings in disease show that the sensory fibres of the sympathetic may propagate their reflex influence both to adjoining and to distant ganglia. Thus paralytic immobility is confined to individual parts of the intestinal tube, and the often painful efforts made by the upper portion give the affection a spasmodic or neuralgic character. In intestinal gangrene, on the other hand, we find the paralysing influence extending up to the heart. The independence of the sympathetic becomes very manifest in these dangerous conditions, from the cerebro-spinal system remaining unaffected either in its sensory or motor sphere. Unfortunately we are as yet lamentably deficient in observations on living individuals, by which we may hope to throw light upon this obscure region of pathology. It is difficult to say whether morbid anatomy with the means now at its command will be able to afford the desired elucidation; as yet the reflex neuroses, for which the sympathetic and its ganglia offer the most productive soil, have not in any way been cleared up by the scalpel or the microscope, even as they occur in the brain and spinal cord.

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[1] See Froriep's Neueste Notizen, vol. xxii, April 1842, No. 465, 466.

The independent character of the sympathetic does not, however, place it entirely beyond the reach of cerebro-spinal influences; divine Providence has guarded the animal economy against unlimited domination of any organ; and even our doctrines of the nervous system have received a new impulse since the despotic supremacy yielded to the brain by older authors has been overthrown. The mutual relation is demonstrated even in the anatomical structure of the parts, for nervous fibres may be shown to pass from the brain and spinal cord to the sympathetic, as well as from the ganglia of the latter to spinal nerves. Well known vital phenomena occurring in healthy and morbid states in man, testify to this mutual influence; we shall confine ourselves to drawing attention to a few, taken from the range of paralytic affections that have not met with due appreciation. I borrow from the records of surgery, to which neuro-pathology is indebted for a more effectual advancement, on account of the absence of prejudice on the part of the observers, the description of a condition which occasionally follows very serious injuries, and illustrates the paralysing influence transferred from cerebro-spinal to sympathetic nerves and ganglia. Travers[1] has termed it prostration without reaction. The following are the main features: the arterial pulse fails and disappears; the beat of the heart is weak and fluttering; the cheeks and lips are cold, pale, and of a livid hue; there is no pain; no anxiety or oppression; apathy; unembarrassed, though rather frigid consciousness; and, finally, sopor; difficult respiration; relaxation of the sphincters, and convulsions. The duration of the condition extends from eight, twelve and seventy-four hours to two or three days. Among injuries, the most frequent causes are extensive burns. Twenty years ago I was called to see the wife of a distiller of 40 years of age, who, in tapping the spirits one morning, had approached the light too near, and in her fright forgot to turn off the cock of the cask. The burning spirits poured on her and scorched almost the entire cutaneous surface. The immediate consequence was an icy coldness and pulselessness in both radial arteries. The abdomen became tympanitic; the alvine and renal evacuations were retained; consciousness was perfectly clear; an answer was given to every question, and the unfortunate woman was even able to dictate her last will and testament to a lawyer. Immediately before death, which ensued eight hours after the occurrence, coma and dyspnœa supervened.[1] Comminution of the bones and laceration of the soft parts are occasionally followed by the same consequences. Thus in the case of a boy, of 13 years, related by Travers, the charge of a musket entered the thigh, and the radial pulse was instantly arrested; the face was pale; the skin cold, and the pupils dilated, as they are after the application of belladonna. There was an inclination to somnolency, but when waked up he was perfectly conscious; he complained of no pain, had an insatiable thirst, and the sopor increasing he died nine hours after the injury. The trochanter and the thigh were comminuted, and the muscles and femoral artery lacerated. The hæmorrhage was trifling even during life; the ends of the artery were almost two inches apart, and had contracted. Nothing abnormal was found in the cranial, thoracic, or abdominal cavities. This condition has also been met with after operations, especially after lithotomy in children.[2]

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[1] See this author's admirable work—An Inquiry concerning that disturbed state of the Vital Functions, usually denominated Constitutional Irritation, 2d ed.; London, 1827, p. 106.

I have already alluded to the anatomical fact that sympathetic nerve-fibres derived from ganglia pass to cerebro-spinal nerves, and accompany them in their course.[3] A direct influence upon nutrition has been attributed to them: in fact, the terms vegetative or organic nerve have been employed synonymously with the term sympathetic nerve. Modern researches, especially those of Henle and Valentin, have effected a thorough reform in these views; and what has hitherto been ascribed to the direct influence of the nerves upon secretion and metamorphosis, may with greater propriety be attributed to the influence exerted by the nerve-fibres upon the contractile elements of the vessels ; our knowledge of the contractile elements, which are removed from the control of the imagination, and the motor power of which takes its origin in the sympathetic, has advanced generally. In this respect the skin demands an especial consideration, and it is indeed strange that the veterinary surgeon pays more attention to its turgor or tone in animals, than the physician does in diseases of human beings. In intestinal gangrene, in which there is an undoubted paralysis of the sympathetic, we find the skin presenting a similar condition as in Asiatic cholera. The skin feels doughy, like soft clay, and if pinched up on the abdomen, or in the neck, remains standing in a doughy, indolent fold, which only subsides by degrees.[1] The debilitating and paralysing influence which derangements in the functions of sympathetic nerves exert upon the cerebrospinal tracts, by means of reflex action through the spinal cord, will be considered when we treat of spinal paralysis.

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[1] Several Cases of this kind are given in Travers' Work, p. 63—80.

[2] Travers', p. 89.

[3] Volkmann; loc. cit., p. 84.

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[1] See—Romberg; Einige praktische Bemerkungen über Asiatische Cholera, in Casper's Wochenshrift für die gesammte Heilkunde, 1833, p. 770.

CHAPTER XLIII.

PARALYSIS IN THE RANGE OF THE CARDIAC NERVES.

The doctrine of Le Gallois, that the heart's action is independent of the spinal cord, is at variance with the well-known phenomenon of the heart continuing to pulsate after it was cut out of the body, or after the destruction of the spinal cord, while *in situ.* Bidder[1] found, on opening the thorax in frogs, in whom the spinal cord had been destroyed several weeks previously, that the heart made as many, and apparently as vigorous contractions, as in others that had just been decapitated ; in one case, twenty-six days after the removal of the spinal cord, the heart was found to beat forty times in a minute, while in another animal, which was not injured, the heart only made thirty-five beats in the same time. A similar relation was observed after the brain or both nervous centres had been simultaneously destroyed, though the phenomenon did not last so long. Remak's[2] discovery of small ganglia on the most minute ramifications of the nerves in the substance of the heart, still more weakened the above-mentioned assumption, and paved the way for the physiological interpretation of the independent character of these nerves. Experiments made upon living and recently killed animals appeared at first to render the conclusions doubtful, but Volkmann[3] has shown that even without any irritation of peripheral nerves of central organs, the heart of recently killed animals generally moves very irregularly, and even after having ceased to pulsate for a considerable period, again resumes the movements, without any external cause. The same distinguished inquirer[4] has observed, that while the entire heart of the frog performed its movements perfectly after being cut out, instant arrest of movement took place in individual parts after certain injuries, from which it follows that there are certain points in the heart from which the impulses proceed, and without which no movements can ever be induced. Kölliker[1] has discovered the point at which auricles and ventricles meet to be the centre of action, for if a heart be cut up into small pieces, those only continue to pulsate which are taken from this part, and no others. Some of the experiments made by Dr. Marshall Hall[2] are of importance in a pathological point of view. After the brain and spinal cord of an eel had been destroyed, the heart continued to beat vigorously, sixty times in a minute. A stroke of the hammer applied to the stomach instantly arrested the movement of the heart, and it continued at rest for several seconds. A contraction then followed; after a long interval, a second took place, and by degrees the full action was restored. In the same manner paralysis of the nerves of the heart and sudden death occurs in many other violent injuries to the abdomen, blows upon the stomach, &c. This effect takes place more slowly in gangrene of the intestines; the contractions of the heart become weaker and weaker, irregular, and intermittent; they are unable to propel the blood far, for which reason there is no pulse in remote arteries, such as the radial and the popliteal, and the surface is cold and presents a blueish-grey hue. The unimpaired state of the intellect, and the continuance of the cerebro-spinal functions of sensation and motion, form a striking contrast with these phenomena.

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[1] Müller's Archiv, 1844, p. 371.

[2] Casper's Wochenschrift für die gesammte Heilkunde, 1839, p. 149.

[3] Müller's Archiv, &c., 1842, p. 373.

[4] Ibid., p. 424.

A temporary arrest of conduction in the motor nerves of the heart, is manifested by immobility of the heart, and by intermissions of its impulse and its sounds. A very instructive observation, which is the more interesting on account of the diagnosis which had been made, has been communicated by Dr. Heine.[3] The patient, a man of 36 years of age, who applied for advice in the Viennese Hospital, complained of a very peculiar affection, which was at first looked upon as one of the numerous symptoms of hypochondriasis; he stated that his heart often stood still. At the very next visit he was, however, able to demonstrate the fact, for there was an intermission of five or six beats of the heart and the pulse. The aspect of the patient showed, that at the time something terrible was going on within him; he sat there as if thunderstruck (attonitus), speechless, motionless, his eyes wide open, his consciousness unimpaired. When asked about his sensations, he stated positively, that for a second, or often more, he had a presentiment of the coming arrest, in the shape of internal restlessness and oppression; that when the stoppage took place, a violent pain seized both sides of the thorax, extending to the neck and then passing up to the nape and the head; that the pain remained fixed in the latter for some time after the attack, and that when the fits were frequent, he could scarcely get rid of a sense of weight at the cervix. He knew of nothing except mental emotions, which had a tendency to produce the attack; that, without any known cause, the malady had irregular periods, during which it occurred much more frequently than at others, as often as ten or twelve times during the day, and that it then would intermit for several weeks; during the six months preceding his application for advice, the fits had become much more frequent. The attack passed off with a sigh, and the action of the heart was restored without any perceptible change in the patient, except that the first beats were rather accelerated. The most accurate examination of the heart during the free intervals, failed to demonstrate any abnormity in the rhythm, the sounds, and the extent of the cardiac dulness. He coughed, and had a slight expectoration, and also complained of frequent vertigo, but he always avoided inquiries about these matters as trifles, in order to return to the subject of the heart affection. Towards evening he had slight febricitations, but never suffered from dyspnœa; he was able to lie on either side, to mount stairs without difficulty, and during the paroxysm his face did not become red with congestion, or present the lividity of suffocation, but was overspread with pallor. The attacks gradually increased in frequency, they endured longer, and the headache and pain at the cervix became persistent; he lost strength daily, was unable to leave the bed on account of vertigo, and died in a state of sopor, which had lasted some days.

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[1] Die Selbstständigkeit und Abhängigkeit des sympathischen Nervensystems, p. 36.

[2] On the Diseases and Derangements of the Nervous System, p. 128.

[3] Müller's Archiv, 1841, pp. 234—247.

Dr. Heine had repeatedly examined the patient with Professors Rokitansky and Skoda; on account of the integrity of respiration, of the movements of the heart, the spinal cord and the other cervical nerves, and from the absence of every paralytic symptom, the affection was diagnosed to depend upon a pseudo-plastic tumour involving the upper cervical plexuses, or the cardiac nerves, with hypertrophy of the cervical portion of the spinal cord. Rokitansky performed the autopsy. The nervus cardiacus magnus, which ascends from the plexus lying between the descending aorta and the pulmonary artery was woven into a black knot of the size of a hazel-nut, by the lax, pale greyish cords forming the cardiac nervous plexus; before its entrance into the knot the nerve was thickened. The branches of the left vagus, which descend upon the anterior side of the left bronchus to the pulmonary plexus, proved to be dragged in the same way by an underlying nodulated, dark blue, lymphatic gland. In the pericardium were two drachms of serum; the heart was of the usual size and tough; in the auricles and in the large vessels there was fluid blood. The bronchial, as well as the lymphatic glands lying along the internal mammary arteries and behind the large vascular trunks, were converted into dark blue, hard masses, containing cretaceous concretions. One of these, the size of a bean, interrupted the phrenic nerve at about the middle of its course, near the root of the lung. With the exception of a small portion of neurilemma that passed over the surface of the mass, the nerve was entirely absorbed into it; above it was thick, and below its size was reduced by two thirds. The solar ganglion was very large, and enveloped by a pale vascular cellular tissue. Greyish serum was accumulated between the spinal meninges. The spinal arachoid, more particularly at the upper lumbar and dorsal region, was beset with osseous lamellæ of the size of a millet seed or a lentil; the pia mater was congested, its vessels dilated, the spinal marrow large and thick, and the cervical portion particularly voluminous; its substance was soft throughout, the grey tissue very pale, and the medullary portion of a pure white. The convolutions of the brain were flattened; the grey matter was thin, the medullary substance pulpy, and the lateral ventricles extremely distended, with about four ounces of clear serum. The left hemisphere of the cerebellum was enlarged at its posterior edge, and close to the surface were numerous tubercles imbedded in the substance, and varying in size from that of a hempseed to that of a pea, of yellow colour and lardaceous consistency. The medullary portion of this hemisphere, with the exception of the crus cerebelli ad corpus quadrigeminum, was of a pale yellow colour and softened. The inferior vermiform process, as well as the medulla oblongata, were pushed over to the right side, the eminences at the base of the cranium were more marked, and the left occipital fossa rather larger than its fellow. The anterior portion of the pituitary body was flattened, the posterior lobe enlarged, rounded, and its substance of a dark rusty colour and pulpy; the cellular tissue connecting the two was infiltrated with a gelatinous mass. The petrous bones were rough and cribriform at their anterior surface, and especially under the external portion of the ganglion Casseri; similar spots were also found on the alæ magnæ of the sphenoid bone. Both lungs were bloated, the cells coarse, and full of blood, they were partly œdematous, and their apices, especially the one on the left side, extensively condensed into a blackish blue, hard nodulated mass interspersed with a greasy, cretaceous substance; a similar spot of the size of a hen's egg, was also found at the anterior and lower portion of the right upper lobe.

Instances of the influence exerted by other organs that are provided with sympathetic fibres, upon the temporary interruption to the conduction of the motor nerves of the heart, often enough occur to the physician, and especially in affections of the intestinal canal. Bilious accumulations, helminthiasis and critical diarrhœa are accompanied by intermissions of the pulse and of the beat of the heart; they precede the occurrence of intestinal hemorrhage.

A paralysing influence is not unfrequently exerted upon the cardiac nerves by the cerebro-spinal system. The movements of the heart are sometimes arrested by violent injury of the extremities.[1] It occurs more frequently as a result of violent emotions and injuries of the head, accompanied by concussion of the brain, in which case, if death does not ensue instantaneously, the reaction may after a time set in, owing to the action of the heart being again excited. Syncope is a similar condition, for the consideration of which I refer to the fourth division of the present work. I am not acquainted with cases in which injuries or diseases of the spinal cord produced a paralysing effect upon the heart.

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[1] Marshall Hall; loc. cit.

The part which the blood takes in the motor action of the heart, even if only effected by the intervention of the nerves, is not manifested in reference to spasm alone, but also with regard to paralysis. Of this we have a proof in asphyctic cholera, the symptoms of which in this respect much resemble those of intestinal gangrene. The specific influence of certain medicinal agents in retarding and temporarily arresting the action of the heart, digitalis, tobacco, or arsenic (in frogs, according to Budge,[1] corrosive sublimate), may be explained by the combined action of the blood and the nervous energy. The experiments instituted by Henry, Müller, and Valentin,[2] show that when a frog's heart is cut open, while it is still pulsating, and the internal surface painted with a solution of tincture of opium, the contraction of the ventricle ceases at once, and cannot be restored by inducing a strong galvanic current.

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[1] Allgemeine Pathologie, p. 139.

[2] Valentin; Lehrbuch der Physiologie des Menschen, vol. ii, p. 60.

CHAPTER XLIV.

PARALYSIS OF THE NERVES OF THE ALIMENTARY CANAL.

We are better acquainted with the paralytic affections of the entrance and the exit of the contractile alimentary tube, which are under the control of the cerebro-spinal system, than with paralysis of the intervening apparatus, the movements of which mainly depend upon the sympathetic.

PARALYSIS OF THE PHARYNX AND THE ŒSOPHAGUS.

Dysphagia Paralytica.

The difficulty or impossibility of deglutition occurs suddenly or by degrees. The transit of solid and liquid substances is impeded. There is no regurgitation; the patient is obliged to extract the morsel, which becomes impacted in the throat, with his fingers, and this is a matter of some difficulty, because it is softened with mucus, which not being consumed in insalivation, accumulates in considerable quantity and runs out of the mouth. When the patient drinks, suffocative attacks supervene, unless the entrance of the liquid into the glottis is prevented by bending the head backwards. If the probang is introduced no impediment is met with. Sensation is generally intact; the patient feels the difficulty of swallowing, and the point at which the morsel is arrested. Sometimes sensibility is even exalted, and there is a sensation of a compressing, constringing body at the upper part of the neck. In the course of time emaciation ensues, but not to such an extent as in carcinoma of the œsophagus.

The cause of œsophageal paralysis rarely resides in the peripheral distribution of the vagus and accessorius; a few instances have already been quoted. The seat is generally central, occupying either the cervical portion of the spinal cord or the cerebrum. Other paralytic symptoms are associated with it. When the vertebræ are affected, or if there is myelitis cervicalis, the upper extremities or the vocal or respiratory movements are paralysed, or paraplegia coexists. Ollivier[1] communicates the case of a student of 21 years of age, whose illness commenced with dysphagia, and with a sensation of a foreign body sticking in the throat, causing sickness and vomiting, as in tumefaction of the uvula. No abnormity was detected on instituting a local examination. At the same time there were violent pains in the cervical region, difficult, sibilant respiration, formication and numbness, first in the fingers of the left hand, subsequently extending to the arm, and afterwards also attacking the right upper extremity. Complete paralysis developed itself. The lower extremities remained unaffected. Dysphagia and dyspnœa increased, and death ensued on the eighth day. The autopsy showed the cervical portion of the spinal cord to be softened to the extent of two inches; the brachial enlargement and the gray tissue were chiefly affected. The arachnoid was adherent to the dura mater at this part, and the pia mater very dense and reddened. The internal parts of the neck were normal. In cerebral disease (hæmorrhage and softening) accompanied by hemiplegia, there is also sometimes a unilateral paralysis of the œsophagus; I have had two patients under my care, who, after an apoplectic attack, were paralysed on the left side, and unable to swallow the morsel if it got to the left side of the pharynx. In three cases Bright[2] found the corpus striatum to be the seat of the disease. Paralysis of the œsophagus has been occasionally observed associated with dumbness or aphonia as a result of violent mental emotion.[3]

In our treatment we have first to attend to the preservation of life by the introduction of an elastic œsophageal tube. The fundamental disease, whether in the spinal cord, the brain, or their membranes, must be attacked by counter-irritants, issues, setons, and the repeated application of cupping-glasses to the cervical region. When there is no inflammatory derangement of the central organs, we must employ strychnia endermically. The cases on record in which electricity was had recourse to, lead us to form a high opinion of its efficacy. Monro, among several successful cases, relates one of a patient who was only able to swallow when sitting upon the electric stool. We should try direct irritation of the pharynx and the œsophagus, in order to excite the contraction of the muscular fibres by reflex action. The older physicians recommended ethereal oils for this purpose, and advised their patients to chew acrid substances; the case given at page 13, of this Volume, shows the utility of introducing a silver ball attached to a wire, and offers an encouragement to repeat the proceeding in similar cases.

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[1] Traité des Maladies de la Moëlle Epinière, 3d ed., vol. ii, p. 319.

[2] Reports of Medical Cases, vol. ii, p. 330.

[3] Joseph Frank; Prax. Medic. Univers. Præcepta, vol. i, p. 126.

INTESTINAL PARALYSIS.

In addition to the features above delineated of the arrested action of sympathetic centres, we find in this case a cessation of the peristaltic movement; and the intestine, possessing no power of resistance, becomes distended with liquid and gaseous fluids (meteorismus, tympanites.) Intestinal paralysis occurs secondarily to other diseases, first of the intestinal canal itself; as in enteritis, in the most marked form in gangrene of the intestines, in peritonitis intestinalis, and dysentery; in blood diseases, typhus, phlebitis and inflammatory or septic puerperal states. Tympanitis puerperalis sometimes threatens danger even without such antecedents. Diseases of the brain and spinal cord are not followed by paralysis of the intestines. The constipation and distension of the abdomen often accompanying injuries, especially of the spinal cord, depends upon paralysis of the abdominal muscles, and the consequent arrest of their compressing power.

The occurrence of partial paralysis of the intestine may be assumed with some probability; the pathological fact of dilatation of individual portions, with softening and relaxation of the contractile parietes, without any constriction or disorganisation below the dilated part, favours the view. Thus we find the stomach so much distended as to fill the abdomen. In the same way local enlargements occur in the colon or in the small intestine amounting to the thickness of the arm; in this case during life there are obstinate constipation and symptoms of ileus, a subject on which Abercrombie[1] has instituted instructive investigations. The curative effect of electro-galvanism also affords a proof of the paralytic immobility of sections of the intestine in cases of this description, in which spasm and inflammation only occur as secondary results.

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[1] Pathological and Practical Researches on Diseases of the Stomach, the Intestinal Canal, the Liver, and other Viscera of the Abdomen, pp. 132—141.

PARALYSIS OF THE ANAL MUSCLES.

The transversely striated muscles of the anus are in a state of antagonism to the organic muscular fibres of the rectum; the sphincter, the levator ani and the transverse perineal muscles, receive their motor impulse from the spinal cord, and lose their power of contraction as soon as the conducting power, whether motor or reflex, of this organ is diminished or destroyed. Very soft liquid excrements and flatus, for the discharge of which the contractions of the rectum suffice, in this case escape involuntarily; while more solid fecal matters, which can only be evacuated with the assistance of the expiratory movements, are retained, as under these circumstances the abdominal muscles are also generally deprived of their action to a greater or less degree.

CHAPTER XLV.

PARALYSIS IN THE RANGE OF THE NERVES THAT CONTROL MICTURITION.

The antagonism existing between the muscular coat of the bladder and the sphincters may continue or be arrested when both systems are seized with paralysis, in the same way as we have found it to be the case in spasmodic affections of these parts.

PARALYSIS OF THE DETRUSOR URINÆ OF THE BLADDER.

Ischuria Paralytica.

This affection is characterised by retention of urine, by the bladder filling visibly and so as to be perceptible to the touch, without any sensation on the part of the patient or desire to micturate. The inability to pass the water is only complete, when there is also paralysis of the abdominal muscles; as long as they can be made to act, the accumulated urine will be forced out in a slow current and in small quantities. After the urine has been removed by the catheter, the bladder continues distended and is incapable of contracting.

PARALYSIS OF THE SPHINCTER.

Eneuresis Paralytica.

The bladder ceases to be a reservoir for the urine, which passes off through the urethra in small quantities, as soon as it is discharged from the ureters; it is often voided drop by drop, following the law of gravitation, and without forming an arched or spiral current. On examining the hypogastrium the bladder is found empty and contracted. There is generally no desire to micturate; if present at the commencement of the disease, it coincides with the involuntary discharge; whereas in health a short interval intervenes between the sense of irritation and the contraction of the bladder, and a long interval in many cases precedes the onset of paralytic ischuria.

PARALYSIS OF THE VESICAL AND SPHINCTER MUSCLE.

As we find spasmodic dysuria and ischuria combined, (see vol. II, page 28) we also meet with a complication of paralytic retention and incontinence; if not recognized, an erroneous treatment will be adopted. As the urine trickles away, that which is retained is not thought of; although the swollen bladder may be so full as to present a fluctuation through the abdominal parietes, especially in thin individuals, as well as through the rectum and the vagina, and although external pressure may suffice to expel a large quantity of urine. The best proof of the extent to which the bladder may become distended is afforded by the fact that it has been occasionally mistaken for ascites. Peter Frank[1] relates an instance of this kind, in which the bladder contained eighty pounds of urine, and had raised up the diaphragm. Brodie[2] describes the post-mortem appearances of a paralysed bladder, from which at one time forty ounces of urine had been discharged by the aid of the catheter. Its size was very considerable; the muscular fibres were atrophied to the last degree. The inner membrane was excessively thin and could be easily detached; the bladder presented an almost black colour throughout, but there were no other symptoms of gangrene.

The causes that produce paralysis of the vesical nerves occupy a peripheral or centric seat. Among the former we have to enumerate excessive distension and expansion of the muscular and nervous fibres of the bladder, by which their irritability is diminished or extinguished. It is sometimes induced by the voluntary retention of the urine commanded by peculiar circumstances,[3] or by repletion of the bladder resulting from mechanical or spasmodic obstacles. Compression by adjoining organs or morbid growths may cause paralysis; thus in females the uterus, whether distended by pregnancy or fibrous humours, may have this effect. Influences implicating the sacrum, and the lower sacral nerves must be here considered; a blow, or fall received upon the posteriors, strong concussion by continued riding, occasionally gives rise to an isolated paralysis of the bladder without affecting the abdominal muscles. Causes acting from one of the nervous centres are more frequent than the former, and especially injuries and diseases of the spinal cord which but rarely induce an exclusive paralysis of the sphincter, but are accompanied by ischuria, which is the more complete, if at the same time there is paralysis of the abdominal muscles and anæsthesia. We must not overlook the important part played by the latter, and as in the causation of spasm of the bladder reflex irritation is a moment of importance, on the other hand the absence of sensation, or more correctly of the centripetal nervous influence, is the cause of the immobility of the bladder, the motor nerves of which may under these circumstances continue susceptible of the stimulus of the will. The reverse is the case when apoplectic, soporous or typhous affections of the brain prevent the individual from becoming conscious of the sensation of the urinary stimulus. In this case there is an absence of the stimulus and control of the will, while reflex stimuli (sprinkling the abdomen with cold water, the application of cold to the soles of the feet, cold water enemata, titillation of the neck of the bladder) excite the action of the motor nerves, which continue possessed of the power of conduction. Desault[1] had a patient under his care of 87 years of age, who was affected with vesical paralysis, upon which calculus supervened. The urine could only be evacuated by the aid of a catheter, but as soon as vesical hemorrhage occurred, not only the blood but also the retained urine passed off readily. A predisposition to vesical paralysis exists in old age, and especially in the male sex and after excess in venery. After

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[1] De curandis Hominum Morbis Epitome, vol. vi, p. 506.

[2] Lectures on the Diseases of the Urinary Organs, 3d ed.; London, 1842, p. 100.

[3] Ambroise Paré (Œuvres complètes ed. Malgaigne, Paris, 1840, vol. ii, p. 498), relates the following in his quaint manner: "A young serving man was returning from the country with a respectable young lady, his mistress, riding behind him, and with suitable accompaniment; and while on horseback, he was seized with a desire to micturate; he did not venture to dismount, and still less to make water in the

saddle. Having reached this town, and wanting to discharge his urine, he could in no way do so, and was seized with great pains; he was covered with perspiration, and almost fainted away. I was then sent for, and the people said it was a stone which prevented him from making water. When I arrived, I put a sound into his bladder and pressed the belly; and by this means he discharged about a pint of water, and I found no stone, nor has he experienced any inconvenience since."

[1] Œuvres Chirurgicales, 3d ed.; Paris, 1830, vol. iii, p. 135.

epileptic attacks, ischuria sometimes occurs which lasts several days. Among the morbid processes rheumatism and arthritis are the most favorable to its production. Paralysis of the bladder occasionally results from the abuse of diuretics. In paralytic retention the danger may be increased by the supervention of disorganisation of the bladder, by reaction upon the kidneys and by alteration of the blood. When there is anæsthesia of the bladder, the reaction upon the brain ensues later than when the sensibility is maintained, and as a rule, paralytic ischuria never proves so speedily fatal as the spasmodic form. The incontinency runs a slower course, and generally terminates by the supervention of paralysis of the muscular fibres of the bladder.

The local treatment is of extreme importance in vesical paralysis. In ischuria the catheter operates not only by emptying the bladder, but also as a reflex stimulus, especially if it comes into contact with the parts adjoining the orifices of the ureters. If there is a difficulty in introducing the catheter repeatedly, it should be allowed to remain in the bladder. In enuresis a thin sound or bougie should be introduced into the urethra; it acts as a stimulus upon the middle and posterior portions and induces contraction of the sphincters. Other reflex stimuli are also employed for therapeutic purposes, such as the application of cold to the cutaneous coverings of the abdomen and the soles of the feet, or to the rectal or vaginal mucous membrane; the rectum may be stimulated by enemata or suppositories. By fulfilling the etiological indications we may sometimes, though rarely, obtain a successful result; thus in diseases of the vertebræ and of the spinal cord, the application of issues or moxæ may prove effectual, or if we have to deal with a rheumatic subject, camphor may achieve our object. A specifically exciting influence is exerted upon the motor vesical nerves by cantharides, both administered internally in doses gradually increased from 5 to 15 drops, and particularly in the shape of a blister applied to the sacrum and dressed with unguentum cantharidum. Lotions, containing tincture of cantharides and the mixtura oleobalsamica applied to the region of the bladder, the back, or the internal surface of the thighs, are less effectual. The nux vomica and strychnine, the latter applied endermically in doses of $\frac{1}{6}$ — $\frac{1}{3}$ grain, sulphates of strychnine and the ethereal oil of turpentine, are also to be recommended. Electricity has long been in favour, and modern experience bears testimony to the value of the douche applied to the sacral and vesical regions. In the paralytic affections of advanced age the invigorating warm mineral baths of Gastein and Wildbad deserve a trial.

PARALYSES DEPENDENT UPON A LOSS OF EXCITABILITY OF THE CENTRAL ORGANS.

CHAPTER XLVI.

SPINAL PARALYSIS.

These morbid conditions vary according as the spinal cord is affected as a conducting apparatus of the medulla oblongata and the brain, or as an exciting central organ of the nervous system.

I. PARALYSIS OF THE SPINAL CORD AS A CONDUCTING APPARATUS.

The physiological characteristic of this morbid condition is the loss of motor conduction for the respiratory and mental impulse in those fibres which are given off at and below the injured point of the spinal cord.

The motor conduction takes place in the anterior columns of the spinal cord. The fact is convincingly demonstrated by vivisections (see vol. II, p. 42,) and occasionally by injuries in human beings; the former sometimes offer an equally precise proof as the latter, as for instance the following case which was observed by Bégin and has been communicated by Longet.[1] A member of the National Guard in Paris, was wounded with a knife in the back of the neck, and instantly fell on his right side. On the day after the accident, he was admitted into the hospital, at which time he complained of no pain, but only of a slight sense of numbness of the right side. The wound at the side of the neck, which was horizontal, and had been plastered up, was found to be 13 millimetres (about half an inch) in length and on a level with the fifth cervical vertebra at a distance of 24 millimetres (about an inch) from the spinal process. The movements of the head and neck were painless and unimpaired. The wounded man felt a weight on the right arm and formication in the hand; he was able, though with some trouble, to raise his arm and to move the forearm, but he was unable to extend or to close the semiflexed fingers. The right inferior extremity was deprived of the power of movement. A vague pain extended over the right side of the thorax; throughout, in the arm, the trunk, and the leg, sensation was completely unimpaired. The other functions continued in perfect order. On the third day after the injury the patient's condition changed manifestly for the worse; the pulse became irregular, the breathing was accelerated, hiccup supervened, the dyspnœa increased, and on the sixth day death ensued. At the autopsy a piece of a broken blade was found in the right side of the arch of the sixth vertebra, the point of which projected between the bodies of the sixth and seventh vertebræ and had passed by the posterior wall of the pharynx. The anterior column of the cord was divided to this extent, from the posterior lateral furrow to the anterior median fissure. The corresponding posterior column was untouched. We have already alluded to similar surgical cases without the post-mortem results.

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[1] Anat. et Physiologie du Système Nerveux, vol. i, p. 331.

We also possess cases of disease limited to the anterior columns, with exclusive loss of the motor conducting power. Hutin records the case of a paraplectic subject, whose legs retained their sensibility intact. The lower ten dorsal vertebræ were found to be carious, and the body of the tenth projected inwards towards the canal so as almost to bend the cord at right angles and to cause it to be reduced to nearly half its size; the atrophy affected exclusively the anterior surface, so that the grey matter instead of being in the middle, was at the surface.[1] A female was under the care of Cruveilhier, who was affected with paralysis of both legs, with contraction of the flexors, sensation continuing unimpaired. From time to time twitching movements occurred in these limbs. Micturition and defecation were under the patient's control. On opening the spinal column and detaching the dura mater, an oval tumour of a grey colour, with a sharp margin, in the vicinity of the second dorsal vertebra, terminating below in a point, lay upon the exterior surface of the spinal cord and was adherent to the arachnoid. The pressure thus exerted

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[1] Bibliothèque Médicale, vol. i, p. 29.

upon the cord was considerable. On section the spinal cord looked as if constricted. It is very rare to find disorganising processes such as inflammation or softening limited to the anterior columns; for though during life we may have undoubted evidence of a limitation of this kind, the cadaveric influences generally suffice to remove it; we allude to the position on the back, the influence of the spinal fluid, the warm temperature and the manipulation during the examination, which is generally not made till 24 or 48 hours after death. This suffices to explain how it is that although in some cases the paralysis is confined to the upper extremities, the softening of the cervical portion of the spinal cord is not found limited to individual segments, but affecting the entire thickness of the cord.[1]

Spinal paralysis generally makes its appearance in the shape of paraplegia, affecting both halves of the trunk at the same time, or in succession. The muscles of the lower extremities and of the pelvis are chiefly paralysed; in the majority of instances exclusively so; or the paralysis commences in these parts and ascends or, though rarely, descends. When a favorable issue takes place the upper extremities are the first to recover their normal state, in contradistinction to what occurs in cerebral paralysis. When the paralysis is incomplete, and when there is merely a diminution and not an abolition of the motor power, movement following an impulse of the will is weaker and more indolent than in health, and is facilitated by supporting the trunk, and particularly by placing it in a horizontal position, a circumstance not observed in paralysis proceeding from cerebral lesion. The muscles, and especially the flexors, are relaxed, though in rare cases they are found contracted. They are sometimes seized with convulsive movements.

A diminution or loss of cerebral, conscious sensation, generally coexists with the paralysis. In the first case, the perception of cutaneous and muscular impressions is not alone obtuse but also retarded; it is a point of physiological interest, as we rarely meet with opportunities of measuring the velocity of conduction, to observe that the conduction of sensation is effected very slowly; it requires, as Cruveilhier[2] has already remarked, from 15 to 20 seconds for its transmission. In some patients it is necessary to repeat the impression several times before they become conscious of it. Even if there be complete anæsthesia, the sense of pain, heat, cold, or formication may manifest itself in obedience to the law of excentric phenomena. When motility and cerebral sensibility are entirely lost, spinal or unconscious sensibility manifests itself in the paralysis dependent upon the spinal cord as a conducting apparatus, by reflex action. The sole of the foot is the part most suited to experiments of this description, we succeed best by tickling, or the application of heat. The reflex movement generally takes place in the foot of the same side, though it may occur in both, in which case the movement is less marked in the irritated extremity; it rarely takes place in the upper extremities if they are also paralysed. Strychnine exalts the spinal sensibility and the reflex action; it is diminished by too frequent a repetition of the experiments, though it is restored by a little rest. In spinal injuries some time elapses before these phenomena are manifested, a circumstance probably dependent upon the concussion of the organ. In the case of recovery, sensibility returns sooner than motility.

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[1] Anatomie Pathologique, livr. xxxii.

[2] Loc. cit., livr. xxxviii, p. 9.

In spinal paralysis there is always some disturbance in the nutritive functions. One of the most uniform symptoms is a tendency to decubitus and gangrene of the parts pressed upon, which occurs the more rapidly, and the more extensively, the sooner the conduction of the spinal cord is interrupted, as in fractures of the vertebræ. Anæsthesia appears to form an essential element in this process, while the loss of resisting power induced by it, causes the parts most exposed to pressure, the sacrum and trochanters, to be sooner attacked than others. Occasionally gangrenous bladders form at the ankles and on the dorsum of the foot, although this is more rarely the case in the affection before us than when the arteries have become impervious. We have next to allude to the constitution of the urine. It is almost invariably alkaline in spinal paralysis, either from its commencement or in its further course. In the former case it is very probable that the renal secretion has been thus changed by nervous influence. Smith[1] emptied the bladder of a patient labouring under traumatic injury of the spinal cord with Read's syringe, then repeatedly injected tepid water, until no trace of alkalescence was perceived; he then again injected a small quantity, which was left in the bladder for from 20 to 30 minutes. When emptied it exhibited an ammoniacal reaction, showing that the urine reached the bladder in this state. On the other hand, when retention of urine occurs in paraplegia, the influence of the stagnating urine upon the mucous membrane of the bladder, the ureters and pelves of the kidneys shows itself as in other cases of ischuria, by exciting inflammation and causing the secretion of a viscid and sometimes sanguineous mucus, and a deposit of phosphates. Dupuytren was among the first to notice that in paraplectic individuals the catheter rapidly becomes coated with incrustations, and Ollivier publishes a case in which, on the eighth day after fracture of the vertebræ, these incrustations were perceived, and on the twenty-second, calculi were voided. On section a false membrane was found on the inner surface of the bladder, which was studded with minute calculi. We possess too few observations to determine the question regarding the quantitative relation of the urinary secretion in spinal paralysis. Sir Benjamin Brodie[1] found that the amount was reduced, especially in injuries of the cervical portion; in one patient it was reduced to four ounces in twenty-four hours. The temperature and perspiration are lessened. The skin becomes dry, squamous, and branny. Dropsical infiltrations are of rare occurrence. Atrophy of the paralysed parts often supervenes.

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[1] London Medical Gazette, 1832, vol. ix, p. 661,

These general features are modified by the seat of the injury or disease, and by the peculiarities of the latter. Dysphagia and dyspnœa accompany cervical affections, and the upper extremities are affected in a greater or less degree by anæsthesia and paralysis. The extent of the respiratory paralysis suffices to determine the limits of the injury. When the dorsal region is affected, the arrest in the activity of the respiratory muscles, and especially of the muscles of expiration, is characteristic; in this case paralysis of the more or less relaxed and flabby abdominal muscles, destroys their compressing power and thus promotes the development and accumulation of the intestinal gases to such an extent as to produce considerable meteorism. In two cases of spinal paralysis that have occurred to me, I have seen the abdominal parietes so pendulous as to resemble a flaccid bladder.

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[1] Observations relative to Injuries of the Spinal Cord, in Medico-Chir. Trans., vol. xx, p. 142.

When the lumbar portion is injured, the paralytic affection resides in the lower extremities and the muscular fibres of the pelvic organs, and it shows itself in the male sexual organs by an absence of erections even when there is persistent retention of the urine. It is the more singular to find priapism more frequently accompanying injuries of the cervical than of the dorsal region. In reference to the seat of injury compared with the region paralysed, it will be well to remember a point to which Ollivier has drawn attention, that the spinal nerves traverse a longer distance from their insertion to the intervertebral foramina, the lower their position in the spinal cord. The spinal column may therefore be injured in the vicinity of the foramina intervertebralia of the lumbar region, and yet the conducting power of several nerves which are destined for the lower extremities be preserved.

The modification of the symptoms dependent upon the peculiar nature of the disease, will be detailed in the section treating of the diseases of the formative sphere of the nervous system. A few general remarks may not, however, be out of place here. Diseases of the bones especially affect the motor functions, and yet frequently spare the sphincters. The fact of sensation being less extensively and frequently involved, is probably owing to the disease residing in that part of the vertebræ which adjoins the anterior columns of the cord. The local symptoms are of greater diagnostic value in paralysis depending upon affections of the bones, than in other spinal paralyses; we find changes in their shape, increased sensibility and tenderness to the touch, and to the application of heat. In these cases the treatment is followed by more beneficial results, both temporary and permanent, than in other forms of paralysis. Narrowing of the foramen magnum occipitale, by thickening of the bone and the dura mater as a source of compression, deserves more attention than it has hitherto met with in post-mortem investigations.[1] Morbid states of the membranes and morbid growths, which act by compression and irritation, without interrupting the continuity of the tissues in the spinal cord, in addition to anæsthesia and paralysis, often give rise to pains and passing muscular contractions. In inflammation and softening, the paralysis generally remains incomplete for a long time, the motor and sensory conduction is retarded, and abnormal sensations, less of pain than of numbness, formication, tension, and pressure, are manifested both in the paralysed limbs and in the back and anterior surface of the trunk. In the latter, they induce the feeling of a hoop or cord encircling the epigastric, and also, though less frequently, the hypogastric region. Spinal hæmorrhage, a disease of rare occurrence, as compared with cerebral hæmorrhage, in addition to sudden paraplegia, gives rise to very intense pains throughout the spinal cord.

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[1] See—Bright's Report of Medical Cases, vol. ii, p. 377.

The functions of the brain are not altered by these paralytic conditions.

Secondary changes occur both in the muscular and in the osseous organs of locomotion of the paralysed parts. The antagonist muscles assume a state of permanent tension, which is distinguished from the momentary and painful contraction caused by irritation of the motor nerve, by laceration and inflammation. The contraction of the flexors is occasionally so considerable, that the heel touches the nates. If the spinal paralysis occurs early in life, and during the first years, the influence exerted upon nutrition, and the form of the soft parts and the bones will be all the greater; the paralysed limb becomes more or less atrophied and distorted; as shown in the following case:[1]

"An unmarried female, aged 54, was a patient in the Salpétrière, for carcinoma uteri; her left leg was completely atrophied, flaccid and pendulous, from seven to eight inches shorter than the right leg, useless in walking and deprived of sensation. Notwithstanding the use of crutches, she had a difficulty in moving the right leg, which instead of presenting the greater development found in individuals who only have one leg at their disposal, presented a diminution of circumference and of muscular vigour, and also an incipient varus. The upper extremities were normal. At the post-mortem, all the muscles of the left leg were found converted into fat, yet provided with sheaths, and recognisable by their fasciculated arrangement. A few muscular fasciculi were yet visible in some of the muscles; in the gluteus four, in the plantaris two were found. In the right leg the muscles of the posterior surface of the thigh, the semitendinosus, semimembranosus, and biceps, were converted into fat. The spinal column presented an angular curvature in the dorsal and lumbar region, with the concavity directed to the left side. The lower portion of the spinal cord was much atrophied, to the extent of about 3½ inches, denser than usual, and of a grey colour. The median fissures appeared effaced at this part, and the tissue was converted into a grey, homogeneous indurated mass. The grey degeneration was much more considerable on the left than on the right side. The perceptible difference was traceable in the nerves going off from this spot. In the vicinity of the second and third dorsal vertebræ, the posterior columns of the cord in the vicinity of the mesian fissure participated in the grey degeneration, and were fused together at the lower portion of the spinal cord. Four or five grey islets were found in the pons Varolii. The left pyramid was somewhat atrophied, and small spots of a grey colour showed above and below the left olivary body. At the posterior left corpus quadrigeminum, a grey spot was also visible, and there were several on the thalamus opticus, and at the lower surface of the corpus callosum. All these spots were of firm consistency and tolerable thickness.

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[1] Cruveilhier; Anat. Patholog., livr. xxxviii, p. 4.

It is a fact of special interest, that the disease of the spinal cord, *e. g.* meningitis, which in infancy may have given rise to paralysis, may have ceased, while the immobility is maintained and increased by progressive degeneration and distortion of the extremities, in the same way as the muscular affection resulting from spasm, may be separated from the cause which has produced it, and remain as a shortening of the muscular fibres. T. Heine[1] has added a valuable contribution to our knowledge of these states, by the publication of the observations which his Orthopœdic Institution in Cannstadt afforded him the opportunity of making, and by which he has earned an enduring reputation. The origin of these affections may generally be traced back to the first period of dentition; or to some acute diseases, such as an exanthematic fever; after which, and subsequent to an attack of convulsions, or, though rarely, without them, the child which was previously in good health, is found to be paraplegic; the upper extremities, and in rare cases, the bladder and the rectum being implicated. The paralysis is afterwards confined to one or both lower extremities, in an equal or different degree. Sensation almost always continues normal. Movement is not entirely abolished, generally continuing in the thighs, though in a less degree, while the function is almost entirely destroyed in the legs and feet. The patient is generally entirely unable to walk or stand, even when the trunk is supported, and locomotion is confined to crawling. The temperature of the legs and feet is considerably below the average; it sinks as low as 14°—17° R., (64°—70° F.), and the colour of the surface is livid. The extremities are invariably atrophied; we less frequently observe an arrest in the general development of the body. The deformity of the limbs becomes more marked with the progress of years, and shows itself in distortions of every variety—contraction of the knee and hip-joint, varus, and inversion of the knees. The trochanters and the patellæ remain imperfectly developed, and the tubular bones present a smaller circumference than they have in health. In the further advance of the disease, curvatures of the vertebral column form in the dorsal and lumbar region. No injurious influence is exerted upon the general health and the duration of life. I am acquainted with one patient who, although obliged to be carried from one chair to another, has married in his fortieth year, and become the father of a healthy progeny.

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[1] Beobachtungen über Lähmungszustände der untern Extremitäten und deren Behandlung; Stuttgart, 1840.

Our therapeutic proceedings must be directed towards removing the secondary local causes of immobility. All attempts at a cure directed against an assumed morbid state of the spinal cord, whether exudation or inflammation, and the application of leeches, issues, nux vomica, electricity, &c. will prove fruitless; while those remedies which tend to encourage nutrition, to remove the contraction and flaccidity of the muscles, and finally to change the shape of the distorted bones, will prove useful; whether we take them from the range of mechanics, of surgery, of the materia medica, or avail ourselves of all three. The delineations of the patients before and after treatment, which the above-mentioned work contains, prove how the continued use of water and vapour baths, frictions, movements of extension and flexion, and tenotomy,[1] assisted by standing and walking exercise (rendered possible by ingenious mechanical contrivances), may improve and cure malformations which at first sight appear incurable, and have originated in an early affection of the spinal cord.

The causes and treatment of the other paralyses dependent upon the spinal cord as a conducting apparatus, will be investigated in the fifth part of this manual; in which the diseases of the formative sphere of the nervous apparatus will be discussed.[2]

In the delineation of spinal spasms, we have already pointed out that the spinal cord is distinguished from the peripheral tracts as a conducting apparatus, by not only representing the sum of the individual nerve-fibres of the nerves, but also by being provided with a disposition of the elementary fibres, which renders the stimulation for definite combinations of movements possible. In contradistinction to the movements produced by spasm, such as we see in chorea, there are paralytic conditions in which this associating faculty is abolished. This derangement is most clearly marked in the extremities, not only by the inability to effect flexion or extension, pronation or supination, adduction or abduction, inversion or eversion, but also by the preponderance of antagonist groups of muscles; this frequently gives rise to peculiar positions and distortions, and a knowledge of the circumstance will much facilitate diagnosis. Thus, the paralytic pes equinus or varus is characterised by great flaccidity of the limb, and the facility with which it may be restored to its normal position; and it is distinguished from other varieties of the same disorder by the emaciation and flabby state of the entire limb.[3] An observation communicated by Longet[4] was the first that contained an accurate anatomical examination of the muscles and nerves of the paralytic varus. The case occurred in a girl of 8 years, affected with varus of the right foot. The extensors of the toes and the peroneal muscles were extended and completely paralysed; the triceps cruris, the tibialis anticus and posticus, were moderately contracted, and like the flexors of the toes continued in the possession of their contractile power. The entire leg was visibly emaciated, and sensibility was normal. The operation of the varus in a short time had a beneficial result, but the child was seized with smallpox six weeks after. During this disease the varus had partially returned.—*Sectio cadaveris.* The tendo achillis and the tendon of the tibialis anticus were found to have reunited perfectly; the pallor of the paralysed muscles was marked, while the others presented an almost normal colour, though somewhat paler than in the healthy foot. The pallor also extended to some of the muscles of the thigh, the biceps, the vastus externus, and the tensor fasciæ latæ. In the two former, some red fasciculi were seen in juxtaposition with the pale ones. The discoloration affected the entire length of the fibres in the muscular fasciculi. The nerves of the right leg were thinner than those of the left extremity. No marked change was perceptible in the spinal cord, or the brain; but the anterior roots of the lumbo-sacral nerves forming the right sciatic nerve, had scarcely one quarter the diameter of the corresponding nerve of the left side, while the posterior roots of both sides presented the proper thickness. The atrophied roots had a brown and almost ochrey colour. Only one of them had escaped atrophy and discoloration.

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[1] Consult V. Breuning; Wiederbelebung gelähmter Gliedmassen durch den Sehnenschnitt; Wien, 1844.

[2] [This refers to an unpublished portion of the Work.]—Ed.

[3] Anatomie et Physiologie du Système Nerveux, vol. i, p. 358.

[4] Dieffenbach über die Durchschneidung der Sehnen und Muskeln, p. 214.

Lead poisoning is the specific cause which most frequently induces paralysis of groups of muscles, associated for certain acts of motility.

CHAPTER XLVII.

SPINAL PARALYSIS.

PARALYSIS SATURNINA.

The upper extremities are mainly the seat of the affection; the lower are rarely involved, and when they are, it is almost exclusively in connection with paralysis of the former; the proportion is about 1 to 6. The paralysis occurs on one side or on both; in the latter case, the corresponding muscles or others, and most commonly the extensors, supinators, and adductors, are affected. The fingers and hands are most frequently paralysed. The middle and ring finger are often alone deprived of the power of extension, and flexed in a right angle upon the hollow of the hand. In a female who was in the habit of handling printers' types, I not long since found the thumb of the right hand affected alone; the abductors and extensors were paralysed, but the adductor, flexor and opponens were exempt. In other cases, the extensors of all the fingers are paralysed and bent inwards towards the hand, though not to the same degree. The patient is able to close his hand voluntarily a little more, but he cannot control the opening; the fingers only return to their semiflexed condition when the impulse of the will ceases to impel the flexors; the extensors are not actively engaged. Tanquerel des Planches[1] remarks, that flexion is not effected as perfectly as in health, because the paralysed extensors are deprived of the elasticity requisite to produce the necessary elongation. The hand is either paralysed alone, or in conjunction with the fingers and the forearm. In the first case, paralysis of the radial and ulnar extensors of the wrist renders every extension impossible; the hand continues rigidly bent upon the forearm, and is therefore unable to execute the movements of adduction and abduction. If the forearm is also paralysed, it will be bent upon the upper arm, and with the hand participates in the loss of supination, so that on account of the preponderance of the pronator teres and quadratus, both are in a state of permanent pronation, and the hand also assumes the position above described. The upper arm is most frequently deprived of its movement upwards from paralysis of the deltoid muscle, while the forwards and backwards movements continue unimpaired, owing to the pectoralis major and latissimus dorsi not being affected.

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[1] Traité des Maladies de Plomb, vol. ii, p. 42; Paris, 1839.

Paralysis of extension induces abnormal positions in the lower extremities as it does in the upper; the clubbed foot, like the clubbed hand, equally results from the extensors of the feet and toes being paralysed. The toes are drawn in towards the sole; the foot points downwards and forwards, and the plantar surface is concave. The movement of the foot towards the leg, as well as adduction and abduction, are arrested. The extensors of the leg, the rectus femoris, the cruralis and the vasti, are chiefly paralysed; the leg is half bent upon the thigh, the patient is unable to raise the extended leg, and finds it easier to go up stairs than to descend. If he happen to lie on his knees, he is unable to raise himself without assistance.

Lead palsy is not always limited to these muscular groups; but if neglected, and if the noxious influences be not avoided, the affection extends to the entire extremities of one or both sides; but still the flexors remain less impaired than the extensors; the elbow, wrist, and finger-joints, therefore, continue in a state of moderate flexion, and the forearm and hand occupy a position halfway between pronation and supination. We never find the muscles rigid, and as little are the sphincters implicated in the paraplegic form of the disease. The paralysed muscles are frequently the seat of a vibrating movement, whereas tremor, like that following mercurial poisoning, is not met with.

This form of paralysis is characterised by atrophy of the muscles and the surrounding cellular tissue and fat, supervening earlier, more rapidly and extensively than is the case in other spinal paralyses; this symptom cannot therefore be regarded as a mere result of inactivity. The outline of the muscles disappears; the posterior and external surface of the forearm, the anterior surface of the thigh where the extensors are placed, waste away and form a striking contrast with the prominent condition of the flexors. In higher degrees of the malady, depressions and fossæ form, which are surrounded by adjoining healthy muscles. At last the muscular tissue disappears entirely, and allows eminences of the bone to project sharply; this may be seen in the deltoid[1] and in the ball of the thumb, which comes to be level with the hollow of the hand.

Sensation is manifested in the majority of the patients; they perceive the loss of motility as a feeling of heaviness, and more particularly as if a weight were attached to the joints. If the arm is raised, and be then allowed to fall down, the patient complains of pain in the axilla, and in the shoulder. There is often a troublesome sense of coldness. In rare cases neuralgic pains accompany the affection; still less frequently we meet with cutaneous anæsthesia.

If the paralysis continues for a length of time, the permanent contraction of the pronators and flexors gives rise to an arching of the back of the hand. Small hard tumours may then occasionally form on the wrist and hand; they were noticed by De Haen and Stoll, and have erroneously been taken for accumulations of inspissated synovial fluid. Tanquerel[2] has investigated the matter in the dead subject, and has found that they are produced by the ends of single carpal and metacarpal bones riding over one another, which may be owing to an elongation and relaxation of the ligaments.

This form of paralysis is rarely a primary affection, it follows or accompanies lead colic, and most frequently supervenes gradually when the latter ceases; it less frequently occurs simultaneously, with a coincident increase and diminution of the paroxysms, and least of all suddenly during the course of the colic, and so as to interrupt it. The majority of the patients only pass through one, two, or, at the most, three attacks of colica pictonum, previous to the supervention of the paralysis, and they are not in any way marked by their intensity. Many remain exempt from the latter as soon as they fall ill with the paralysis. In others the imperfectly cured paralysis is augmented after every fresh attack of colic.

There are other sequelæ of this poisoning which co-exist with the lead palsy. Among these the cutaneous anæmia occupies the first place. It is proved by the pale yellow complexion, the sallow earthy hue of the skin, the weak, indolent beat of the heart and the arteries, and the œdema. Andral[1] found that the blood corpuscles were much diminished, while the fibrine and the other constituents of the blood were not implicated. The powers of reproduction are sunk; there is general emaciation, and a state of marasmus. The lead palsy generally supervenes slowly, and is preceded by weakness, numbness, clumsiness, and great susceptibility of fatigue. When an entire extremity is affected, it generally takes a downward course, commencing at the upper arm or thigh. The disease lasts a long while; it generally extends over several years, with an alternation of amelioration and exacerbation of the symptoms. Occasionally the hypoglossus, the vagus (its recurrent branch), and the nerves of the respiratory muscles, are drawn within the range of the paralysis; in the latter case, the fatal issue will be accelerated, which, under different circumstances, may be induced by apoplexy, or by complication with other diseases.

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[1] Vidi ac demonstravi in nosocomio, Deltoidis utroque in latere sic evanuisse carnem, ut ejus loco nihil nisi membranaceum quid tactu perciperetur. De Haen; Ratio Medendi, vol. x, p. 100.

[2] Loc. cit., pp. 44, 139, 150.

The post-mortem investigations made by Andral,[2] Gendrin,[3] and Tanquerel,[4] are very satisfactory, both as to number and accuracy, and they agree as to the absence of perceptible changes in the central and peripheral nervous apparatus. In only one case the ulnar and radial nerves were found atrophied; and only in two there was an appreciable amount of serum within the cavity of the cranium and the vertebral column. The paralysed muscles present the following appearances: the muscular fibres lose their original form and are atrophied, they present a pale-yellowish or whitish colour, become friable, sometimes dry up, as if mummified, and contrast strongly with the fleshy and normal appearance of the other muscles. Molecules of lead are stated to have been discovered recently by chemical analysis, in the paralysed extensors; the ligaments are more flaccid, easier torn; the synovial fluid is scanty, and of a yellowish colour; the extremities of the articulations of the bones of the head are found deprived of their smooth, shining surface.

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[1] Essai d'Hématologie Pathologique, p. 52.

[2] Clinique Médicale, vol. ii, p. 227.

[3] Traduction des Maladies de l'Encéphale per Abercrombie, 2d edit. p. 576.

[4] Loc. cit., pp. 77, 144, 149.

The predisposing cause of this paralytic affection is lead, in whatever manner and by whatever passages it may have entered the blood in a molecular state of oxidation; for we possess no satisfactory proofs of its directly paralysing the motor nerves in their peripheral distribution. The strongest evidence against this assumption is afforded by the following facts: that the extensors are more liable to the affection than the flexor muscles; that the paralysis is limited to the fingers in persons who have to handle it, like type-founders, printers, and those who roll out lead; that the paralysis is induced by lead poisoning, by adulterated wines, by water, and beverages which have been kept in leaden vessels, and even by the medicinal use of acetate of lead; and, lastly, that the respiratory and lingual muscles are affected. An atmosphere impregnated with lead is the most frequent cause of lead poisoning; for this reason persons working in sugar of lead manufactories are most liable to it, and the effect is not confined to human beings, but also extends to animals. The horses employed in the mill are subject to roaring, owing to paralysis of the vagus; and they can only be kept alive by tracheotomy. Rats living in sugar of lead factories may be easily caught and killed on account of their hind legs becoming paralysed. Workmen occupied with rubbing up the red and white oxides with turpentine and other oils are also very frequently affected with the disease. The development of the malady is favoured by the abuse of spirituous liquors, by venereal excesses, want of cleanliness, and cold.

Besides lead, we find that arsenic may also give rise to paralysis.[1] Sir Benjamin Brodie[2] found in his toxicological experiments upon animals that half an hour after the poisoning paraplegia supervened, while Tanquerel and others have failed to induce lead poisoning in animals artificially. In the cases hitherto published, the characteristic signs of paralysis saturnina were absent; both lower extremities were seized,[1] or it affected also the flexor muscles, and was accompanied by loss of sensation.

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[1] Christison—On Poisons, 2d ed., p. 292.

[2] Philos. Transact., 1812, Part 1, p. 212.

Circumstances favouring recovery are, the recent occurrence of the paralysis, its being limited in extent, the atrophy being moderate, the patient being young and robust, and the spring and summer seasons.

It is impossible to cure the paralysis or to prevent its return unless the noxious occupation is given up. The cure is much promoted by sojourn and exercise in the open air, when the atmosphere is dry and warm; this in itself suffices to remove some of the milder forms of paralysis. The most trustworthy remedies are, nux vomica, electricity, and warm baths. Strychnine may be appropriately exhibited both externally and internally; when applied endermatically, even the smaller doses, $\frac{1}{8}$, $\frac{1}{6}$, and $\frac{1}{4}$ grain, should be carefully watched. The blisters should be applied upon and in the vicinity of the paralysed parts; among forty patients treated by Tanquerel with this alkaloid, there were only four in whom no perceptible effect was observable. The duration of the cure on an average was two months.

The warmest advocate of the employment of electricity, De Haen, states that, combined with other remedies, it is the most effectual agent we possess:[2] calculo iterato subducto evictum est, virtutem electricam cum cæteris artis præsidiis, quæ solida fluidaque ad eandem aptent, paralysin expeditius curare quam absque illis. It is most essential that whatever form of electricity be exhibited, whether electro-puncture or electro-magnetism, we should persevere in its use. Among the baths, the sulphur baths are the most efficacious; those artificially prepared are valuable, but the natural thermæ are considerably more so. After the first bath a blackish precipitate of sulphuret of lead is often perceived at the extremities. Dry frictions and inunctions, with the ethereal oil of turpentine, and with the unguentum nervinum, are to be recommended. Pemberton states that when the hands are paralysed the cure is promoted by applying splints to the volar or flexor surface. When entire limbs are paralysed, the recovery takes place from above downwards; the activity of the skin is stimulated and the volume of the muscles is restored.

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[1] De Haen; Ratio Medendi, vol. ix, p. 240.

[2] Loc. cit., p. 109.

It is not always lead poisoning that gives rise to this particular form of paralysis. It is met with in individuals in whom the most careful examination fails to show an influence of this kind. But in this case it is not limited, nor does it exclusively affect the extensor muscles, but also attacks the flexors. It is uniformly accompanied by atrophy, while sensibility generally continues unimpaired. Bell[1] possesses the merit of having first described this variety, in the following words:

"The paralysis does not extend to a part of the arm or leg, nor is it a defect reaching so far up the limb or so far down the limb, but it is an affection of the muscles which are naturally combined in action, although these muscles be in different parts of the extremity and are supplied by different nerves as they are by different arteries. For example, the muscles of the thumb may be affected, but then the wasting will not be confined to the short muscles of the ball of the thumb, but will extend to those muscles of the thumb which lie upon the fore arm; and these wasted muscles are seen lying in contact with others which are plump and powerful."

The following case, observed by the same master of our art, which has been published in an edition of his works that has appeared since his death,[2] well deserves a place in this work: "In a man 40 years of age, who had formerly been a coal-heaver, the flexors of the left hand and fingers, and the muscles of the thumb, were much atrophied; the extensors of the hand and four fingers and the supinators were normal. The muscles forming the ball of the thumb were so much atrophied that a considerable depression was visible between the metacarpal bones, and the flaccid skin lay immediately over the bones. Among the muscles lying at the outer side of the fore arm, which presented their usual dimensions, the three extensors of the thumb were remarkably emaciated, and in this point resembled the muscles enveloping the thumb itself. The movements of the thumb were entirely destroyed, the power of bending the wrist was very weak, flexion of the fingers was impossible, but the power of extension was maintained and was executed if the hand of the patient had previously been closed. On the right side the scapula and upper arm were affected; the prominent parts of the former projected as much as in the last stage of phthisis. The trapezius, the latissimus dorsi, and the other muscles uniting the scapula to the trunk, were vigorous and plump; but the supra-spinatus, the infra-spinatus, and the deltoid appeared atrophied to the last degree. Owing to the atrophy of the deltoid, the acromion, the coracoid process, and the caput humeri were sharply defined under the skin. The entire biceps humeri was very much reduced, and felt like a thin cord from the shoulder to the elbow, where the skin was thrown into loose folds. The triceps on the other hand was as full and strong as in a robust man; the patient was unable to raise his arm, and could only swing it by moving the whole body. He was equally unable to bend the elbow-joint, though he could extend it with full force. His usual posture at once betrayed the affected muscles. The right arm lay across the thorax, supported by the left hand. In this way he was able to use his right hand at will. The affection had commenced three years previously with a pain extending from the left shoulder to the elbow, which he was obliged at the same time forcibly to extend. The emaciation of the muscles of the thumb was accompanied by a constant and often violent pain. A year and a half later, the right shoulder also began to be affected in the same way, and with pain. The general health was good, and continued unimpaired."

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[1] The Nervous System, 3d ed., p. 429.

[2] The Nervous System of the Human Body, with additions, 3d ed.; London, p. 432.

I have hitherto met with three such cases of paralysis. The first occurred in a coachman aged 50, whose malady coincided entirely with the one just detailed; excepting that the paralysis of the fore arm and hand affected the right side, and that of the upper arm and shoulder the left side. Sensibility was complete, but the atrophy at last extended to such a degree that nothing but skin and bone, with all their prominent points, was to be felt. The skin was not dry and jagged at the paralysed parts, but soft and moistened with perspiration as in health. Death ensued ten years after the supervention of the paralysis, from phthisis pulmonalis. Unfortunately, a post-mortem examination was not permitted.—The second patient, a foreign merchant, aged 52, who had formerly suffered from hæmorrhoids and gout, was attacked two years and a half previously to consulting me with severe pains in the left shoulder, which extended along the arm to the head; it was followed by a sense of dull numbness in the index and middle fingers, although the skin of the fingers continued very tender to the touch. The entire arm lost its former strength and usefulness. During the following year, while using the cold douche, the tips of the fingers of the right hand died away, and soon after they became very weak. A year after, the muscles of the left thumb were observed to become atrophied, and a few months later those of the right also; no neuralgic pains in this arm having preceded. It is not long since some tenderness has manifested itself in the skin of the right thigh; the sphincters continue in the full possession of their vigour.—The third case exhibits the disease in its highest development and extension, with the phenomenon of oscillation of the muscular fibres. W. S., aged 36, a waiter, formerly in the enjoyment of robust health, was seized three years ago with vibrating movements in the ball of the right hand, which was associated with remarkable weakness of the thumb. Soon after, the other fingers also became affected, the weakness and the oscillations extended over the fore and upper arm, then travelled to the pectoral muscles and passed to the left arm, which soon presented the same condition as the right one. From the commencement, the parts affected became emaciated. After a year and a half the patient applied for medical advice, but all measures that have been adopted hitherto have failed to arrest the disease. In March, 1845, the following was the condition of the parts: both extremities were paralysed, the only way in which the patient was able to raise the arms was by moving the trunk in a corresponding direction, so that the arms were thrown up. The fore arm and hand were weaker than the upper arm; he was unable to close his hand firmly. The patient was so helpless as not to be able to dress or undress, or even to eat, without assistance. At intervals, as often as twenty times a day, painless contractions of the left middle finger occurred; for the previous six months debility of the lower extremities had supervened, the individual was unable to stand for any length of time; his walk was heavy, and at night there was frequent spasmodic action in the calves of the legs, by which the heel was drawn up; the patient tried to overcome it by forcibly pushing the soles of his feet against the bed-posts. The atrophy of the muscular tissue was most evident in the muscles of the ball of the thumb, in the flexors and extensors of the fore arm and finger, in the biceps, which resembled a mere membranous expansion, in the triceps and deltoid, owing to which the shoulder-joint had lost its rounded outline, and looked as if it was dislocated, and in the supra-spinatus and serratus anticus major. In a lesser degree the pectoral muscles, the latissimus dorsi, trapezius and sterno-cleido-mastoid, presented symptoms of atrophy. An oscillation of the muscular fasciculi was perceived to prevail over the whole body; it was much augmented by the influence of the cold air after undressing, and the patient himself was sensible of it. It was most marked in the upper extremities, in the thoracic, cervical, and dorsal muscles, slightly in the abdominal muscles, and was entirely absent in the face. For some time past, the vibrations had also manifested themselves in the muscular fasciculi of the tongue, by which articulation and deglutition were much impaired, although the tongue continued freely moveable in all directions. The function of sensation was so vivid that the patient could distinctly feel a fly crawling over his hand. His health was unimpaired in other respects; micturition and defecation were normal, and he was still able to perform the marital duties. At the time of the examination, the muscles of the neck had become paralysed, so that, unless supported, the head fell forwards.

The cause of the affection often remains a mystery; neither my own patients nor those of Sir C. Bell had ever handled lead, and they showed none of the other symptoms of the lead poisoning. This form of paralysis is said to occur frequently in England among individuals carrying heavy weights on their back and shoulders.[1] Occasionally a distinct rheumatic exciting cause may be demonstrated. Tanquerel[2] relates the case of a tailor who being intoxicated went to sleep in a shady place from four to ten o'clock one evening, and on waking up, found himself affected with paralysis of the extensors of the hand and

[1] See—Cyclopædia of Practical Medicine, art. Paralysis, p. 251.

[2] Loc. cit., p. 70.

fingers. The merchant above mentioned, after several attacks of influenza, retained an extreme sensitiveness of the skin to the slightest changes of temperature and to atmospheric influences, and from this time he had suffered from an annoying sense of tremor and vibration in the muscles. The waiter traced the commencement of his illness to a violent cold, caught by cooling himself in a damp garden cellar when he was copiously perspiring after violent fatigue. One of Sir Charles Bell's patients had immersed his arm, while dripping with perspiration, into a tub of cold water, and had held it there for a time; this was followed by tremor and subsequently by paralysis and atrophy of the upper arm. This form of paralysis has occasionally been met with as a sequela of acute exanthemata. The prognosis is very unfavorable; in none of the cases hitherto published has the treatment (electricity, strychnine, champooing, douche, moxæ, setons, the Russian vapour bath, &c.) proved of the slightest avail, either in curing or in arresting the disease. Possibly the persevering use of the waters of Gastein or Wildbad might prove beneficial.

CHAPTER XLVIII.

SPINAL PARALYSIS.

II. PARALYSES DEPENDENT UPON THE SPINAL CORD AS A CENTRAL ORGAN.

A diminution and loss of the reflex action as well as of the generation of the motor power characterise this form of immobility and paralysis; it is a subject which presents great difficulties, and we are yet but imperfectly acquainted with its history; continued research is necessary for its elucidation.

REFLEX PARALYSIS.

While we are possessed of physiological facts by which we may estimate and interpret reflex spasms, we are lamentably deficient in our interpretation of reflex paralysis. Excepting the influence exerted by the fifth upon the arrest of the facial movements and of the optic in producing immobility and dilatation of the pupil, we have not as yet obtained any results by experiments upon living animals. I have been the more anxious to supply the defect by pathological observations. I remind the reader of the altered balance of movements in amaurosis, of the dumbness caused by anæsthesia of the acoustic nerve, and of the reflex immobility of the muscles of the facial, ocular, respiratory, vocal and vesical muscles. But the site of the loss of centripetal excitement is only too often concealed; and although the diagnosis of reflex paralysis is facilitated by the faculty of producing movement by the impulse of the will, the duration of the excitability is limited, because the longer the reflex influence is arrested, the less susceptible the motor apparatus becomes for cerebral stimulation; on the other hand the faculty belonging to the spinal cord as a central organ of communicating its conditions gradually widens the limits of the original affection. The most difficult point undoubtedly is to determine the sensitive source of reflex action in the range of the sympathetic, whose stimulating influence upon spinal nerves through the intervention of the spinal cord has been proved by experiments upon animals as well as by pathological facts. Convulsive movements of one or both hind legs, less frequently of the fore legs, are produced by pinching up with the forceps a portion of intestine, mesentery, bladder, ovary, or an intestinal nerve, in a decapitated frog or suffocated rabbit.[1] Experiments with an opposite paralysing effect can scarcely be looked upon as convincing, unless entire organs are detached from their nervous connections. The experiments of Comhaire upon the kidneys, though instituted with a different view, come under this category. Extirpation of a kidney in living dogs instantly induced a paralytic weakness in the hind leg of the same side. The mere incision through the skin and muscles failed to produce this effect. Both in human beings and animals morbid states produce similar effects, which have hitherto been attributed to a direct pressure of the viscus upon the nervous plexuses of the extremities, although neither tumour nor induration could be traced by which to account for the compression, and although there is neither a plexus nor a trunk of a nerve in the vicinity, nor any pain was manifested in the paralysed parts, a symptom inseparable from traction of sensory fibres of the spinal system. Besides the experiments of Comhaire afford a convincing proof to the contrary.[2]

The stimulating and invigorating influence exerted by the hygienic relations of our abdominal viscera has not as yet been duly estimated, although phenomena of daily occurrence point to it, viz., the activity or indolence of our legs according as the alvine evacuations are easy or retarded. Nor is there only a generally stimulating and invigorating influence, but we find in paralytic states, as in reflex spasms, a relation existing between sensory and centripetal nerves and definite motor tracts, which can only be referable to a peculiar disposition in the central apparatus. It naturally suggested itself that the brain, like the sympathetic, contains a number of distinct motor centres; Volkmann's[1] beautiful discovery of the nervous centre of the lymphatic heart in the frog, of the anterior one in the cardiac region of the third vertebra, of the posterior lymphatic heart in the vicinity of the eighth vertebra, serves to corroborate this conjecture. It is probably not too bold an hypothesis if we explain reflex paralysis by assuming the existence of similar nervous centres for the upper and lower extremities, and their connection with centripetal fibres derived from the various organs. Whatever may be the real state of the case, the development of our knowledge in this field promises very beneficial therapeutic results; for it is undeniable that the assumption of a primary affection and disorganisation of the spinal cord, which we are but too ready to jump at in every paralytic affection, is in most cases very hopeless, and unproductive of benefit either to the patient or to his medical attendant.

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[1] Valentin; Lehrbuch der Physiologie des Menschen, vol. ii, p. 756.

[2] Dissertation sur l'Extirpation des Reins; Paris, 1803.

We now proceed to consider—

1. *The Reflex Paralysis arising from Intestinal Affections.*—It is not only lead poisoning which gives rise to colic, accompanied or followed by paralysis; a similar relation is also occasionally observed under other circumstances. There is generally persistent and obstinate constipation, bilious vomiting supervenes from time to time, and there are violent pains in the abdomen which are not increased by external pressure. After the attack has recurred several times, the extremities are deprived of their motor power, either the upper or the lower of one or both sides at first may be affected; the paralytic condition is as transitory as the attacks themselves; afterwards it becomes more enduring, and is occasionally associated with pain, and commonly with atrophy. In a horizontal position the patients are able to move the paralysed legs by an impulse of the will, which they are unable to do in the erect position. Anæsthesia is rarely present. The sphincters act normally. The paroxysms of the intestinal affection often recur after the paralysis has supervened. The following case which we borrow from Dr. Graves's work[2] may serve to illustrate the foregoing remarks:—

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[1] Nachweisung der Nervencentra von welchen die Bewegung der Lymph und Blutgefässherzen ausgeht, in—Müller's Archiv, 1844, p. 419.

[2] A System of Clinical Medicine, p. 411; Dublin, 1843.

"Mr. B., aged 73, was remarkably strong and healthy, though of a spare habit. He was able to take a great deal of exercise, capable of enduring much fatigue, and passionately fond of hunting, fishing, and shooting, particularly the latter; and in pursuit of his favorite amusements frequently exposed himself to wet feet during his excursions through bog and lands, and when wading in the water. These habits, however, he laid aside after the occurrence of the first attack of his illness, which happened in 1829. He had for many years been of a costive habit, his bowels being frequently confined for a week at a time, but did not experience any sensible bad effects from this circumstance, and never took any aperient medicine. Since the first attack in January, 1829, this state ceased, and his bowels became ever after inclined to looseness, which always increased before the appearance of one of the attacks, accompanied by griping, nausea, and inclination to vomit. Each attack was generally preceded by a copious secretion of insipid watery fluid in the mouth, and then the characteristic symptoms of his disease commenced. These consisted in obstinate and protracted nausea and vomiting; he first threw up whatever happened to be on his stomach at the time, and afterwards every thing he swallowed, whether solid or liquid. The matter ejected was at first acid, and afterwards bitter, varying in colour from mucous to bilious, but being generally of a greenish, and occasionally of a bluish tinge. The greenish fluid annoyed him much from its extreme bitterness, and the quantity thrown up in the course of a day varied from three to four quarts of fluid. He complained also of pain referred to the stomach or lower part of the chest, which continued throughout the attack, being more acute at its commencement; for the last year this feeling had passed into a sense of painful constriction, which he described as a contracted feeling of his inside, and compared it to something like the effects of a cord drawn tightly, so as to compress or strangulate his body, exactly along the outline occupied by the insertions of the diaphragm. During the prevalence of the attack he had profuse perspirations, particularly towards the termination of each paroxysm. The duration of the first attack did not exceed five or six days, after which he became quite well, and continued so for six or seven months, when his symptoms suddenly returned. He began to reject everything from his stomach as before, but in the course of a few days the vomiting disappeared, and for a considerable interval he had no return of the complaint. In the year 1830, he had three attacks of a similar description; from these he also recovered completely, and without remarking any diminution of power in his lower extremities. In 1831, however, the disease began to assume a more serious aspect; the paroxysms became much increased in severity, lasted longer, and recurred at shorter intervals. For one of these attacks he took mercury, and was salivated. In 1832 his symptoms became still more violent, and the duration of the paroxysms more protracted. He had one in March, a second in May, a third in June, each of which was accompanied by some numbness and loss of power in the lower extremities. This, however, was slight, and disappeared altogether as the vomiting subsided. About this time he noticed that his urine was scanty, and deposited more sediment than usual. He also complained of being very apt to catch cold whenever he got out of bed, and stated that he suffered occasionally from severe twitches and pains in his legs, thighs, arms, and other parts of his body, which were generally succeeded and carried off by profuse perspirations.

"In August, 1832, he had a violent attack, which lasted nearly a month. The vomiting was incessant, continuing night and day, and he suffered severely from the painful constriction already described. On getting up after this attack, his legs suddenly failed him, and he dropped down on the floor quite powerless. The paralysis did not now disappear during the intervals, although it grew somewhat better after each fit of vomiting had ceased; indeed he used to improve in his walking after the paroxysm had entirely disappeared; and aided by two sticks supported himself so as to give some hopes of a recovery, until a recurrence of his attack reduced him again to a state of almost total paraplegia. His legs now began to waste sensibly, and he noticed that they had lost their feeling and were remarkably cold. He also complained of severe twitches of pain in various parts of the body accompanied by profuse night sweats and turbid scanty urine.

"For some months before his death he was completely paraplegic, and continued to be attacked with violent fits of vomiting. The vomiting went on night and day, and he was unable to retain the mildest and most soothing substances for a moment on his stomach. Mr. Crampton and Dr. Ireland attended him with me, and we had recourse to everything we could think of to allay the irritability of his stomach, but in vain. After continuing to resist obstinately every form of treatment for five or six days and nights, the vomiting would suddenly cease; the gentleman would exclaim, "Now I am well," and he could then eat with perfect impunity substances which would prove irritating and indigestible to many stomachs. This was one of the most singular circumstances I ever witnessed. The transition from a state of deadly nausea and obstinate retching to a sharp feeling of hunger used to occur quite suddenly. One hour he was the most miserable object you could behold, racked with painful constrictions across the epigastrium, alternately flushed or bathed with cold perspiration, and rejecting everything from his stomach, the next found him eating with a voracious appetite whatever he could lay hold of, and digesting everything with apparent facility.

"No trace of organic disease could be detected in his abdominal viscera, and there was not the slightest tenderness over any part of the spine. He also retained to the last a complete control over the bladder and rectum.

"At length his system began to give way; long confinement to bed, and frequent recurrence of these exhausting attacks, completely wore him out, and he sank on the 30th September, 1833. A post-mortem examination was allowed by his friends, and we scrutinized every part of his system with the most anxious care. The brain, cerebellum, spinal cord, and their investing membranes, were carefully inspected. We examined the large nervous trunks that supply the lower extremities, inspected the viscera of the thorax, and searched for evidences of disease in the stomach and intestinal tube. We could find none. There was no lesion of the brain or spinal cord, no thickening or vascularity of membranes, the large nerves exhibited their normal condition, the stomach was perfectly healthy, the intestinal canal natural, the liver and other glandular viscera of the abdomen without any trace of appreciable derangement."

We do not always find that all the muscles of the extremity are paralysed after the attack of colic, but, as in lead palsy, only certain groups suffer, and especially the extensors of the hands and fingers, which speedily become atrophied. In the cases on record which have been accurately detailed, (among which we mention two that are particularly instructive, contained in the Collections from the unpublished Medical Writings of the late Caleb Hillier Parry,[1]) it is expressly stated that there was no ground for suspecting lead poisoning. Occasionally the disease may be traced to catarrhal influences and the abuse of wine and spirituous liquors. I remember a case of the kind occurring in one of our most distinguished actors, whose too free libations to Bacchus were the undoubted cause of the malady.

Besides this intestinal affection, for which I have retained the collective term colic, because, as I remarked on a former occasion, I look upon the pain and the antiperistaltic tendency not as a symptom of neuralgia or spasm, but rather as the painful effort of the upper portion of the intestine to overcome the resistance caused by the immobility and paralysis of the lower,—besides this affection, there are other diseases of the intestinal canal which enter into a relation with paralysis of the extremities. Thus we find that during enteritis paraplegia may supervene, which will continue after the cure of the former until the death of the patient, without exhibiting any structural changes. Graves[2] communicates several cases observed in man, and it has also been met with in animals, such as horses and cows.[3] Paralysis has also been observed to occur in conjunction with dysentery. Thus Frank[4] says, in reference to this subject, "The pain occasionally rises to such a pitch in some individuals, that, as in lead colic, a paralysis of one or the other foot may result." The following description is taken from an old dissertation by Fabricius, 'De paralysi brachii unius et pedis alterius dysentericis familiari."[1] "Some persons who suffer from epidemic dysentery, and more particularly from the severer form, having at the commencement neglected to employ mild evacuants, and especially rhubarb, or having at once taken too large a dose of astringents or opiates, arrest the painful sanguineous discharge and seem to recover to a certain extent, but are at the same time seized with immobility of one arm and the foot of the opposite side; with this symptom violent arthritic pains are occasionally associated, but most frequently these patients lose all sensation. This affection persists in the limbs once attacked, or leaves them to settle in the opposite extremities; unless treated by suitable remedies, it frequently lapses into an incurable paralysis."

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[1] London, 1825, vol. i, pp. 527 and 533.

[2] Loc. cit., p. 401.

[3] Journal Pratique de Médecine Véterinaire, 1829, p. 549; Receuil de Médecine Véterinaire, 1829, p. 350; and Dr. Henoch's Abhandlung über vergleichende Pathologie der Bewegungs-Nervenkrankheiten der Menschen und der Hausthiere, in—Denkschriften des Deutschen Vereins für Heilwissenschaft, vol. i, 1845, p. 51.

[4] De curandis Hominum Morbis, lib. v, p. ii, p. 497.

In treating these forms of paralysis we but very rarely have occasion to pay any attention to an inflammatory affection of the intestinal canal; because, though present in the first instance, it has now become extinct and has left great torpor. It is this condition that must be attacked as the older physicians have done before us, whose finer appreciation of the action of remedies may yet serve as our model. Among the drugs there are three that deserve especial mention, colocynth, gratiola, and helleborus niger; they should be given cautiously, so as to stimulate and avoid all drastic action. Colocynth may be given in the form of tincture, from 5 to 10 drops, by itself or combined with equal parts of the tincture of hellebore, from $\frac{1}{3}$ to $\frac{1}{2}$ a grain of the extract of colocynth three times a day in pills, with an addition of about $\frac{1}{6}$th of a grain of squills. Baths, and especially the mineral waters of Marienbad and Wiesbaden, according as the character of the individual is erethic or torpid, are to be recommended. Intestinal baths exhibited by means of enemata, to which we may add stimulant substances, are appropriate in these cases. With these remedies we may combine the use of friction, counter-irritation of the abdominal surface and the extremities, by flying blisters, electric shocks, the douche to the abdomen, the spine, and the extremities, and the internal administration of nux vomica, (the spirituous extract in doses of $\frac{1}{4}$ to 1 grain.) We should avoid applying issues to the spinal column.

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[1] Helmstadt, 1750, to be found in Haller's—Disputationes ad Morborum Historiam et Curationem Facientes, vol. i, p. 104.

2. *Reflex Paralysis dependent upon Affections of the Urinary Organs.*—We have already discussed the influence that injuries and diseases of the spinal cord exercise upon the kidneys and bladder; we now have to consider the action of diseased urinary organs upon the spinal nervous centre. Stanley, Stokes, and Graves have recently published cases which are intended to demonstrate that paraplegia may result from renal disease; these authors lay a great stress upon the fact that the post-mortems exhibited no lesions in the brain and spinal cord. This statement will not be received with implicit faith unless the organs in question and their envelopes are examined by a professed anatomist; and cases may be quoted in which, notwithstanding the renal disease and the healthy condition of the spinal cord, a morbid alteration was found in the vertebræ, or even in the ligaments of the spinal column.[1] This renders it the more imperative to look for further facts that may serve as evidence of the connection adverted to. We have already mentioned the convincing experiments of Dr. Comhaire on the production of paraplegia by the extirpation of the kidneys in dogs. A similar effect is produced by over-doses of diuretic medicines in human beings and animals. Sir Benjamin Brodie[2] relates the case of a man, aged 63, who by mistake swallowed a liniment containing a large quantity of tincture of cantharides, and in spite of an emetic taken three quarters of an hour after, was seized with paralysis of both inferior extremities and ischuria. During the first weeks it was necessary to evacuate the urine by the catheter; subsequently the patient recovered the power of voluntarily discharging his urine, but he suffered from constant dysuria. After the lapse of four years the paralysis was so much improved that he was able to walk with the aid of crutches, but the painful symptoms continued; occasionally he was seized with a sudden desire to micturate, and discharged a small quantity voluntarily; at other times the urine passed off without the patient's will or knowledge. Sir Benjamin found the bladder empty when he applied the catheter.

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[1] Key—On Paraplegia depending upon Disease of the Ligaments of the Spine, in Guy's Hospital Reports, vol. iii, pp. 17—34.

[2] Lectures on the Diseases of the Urinary Organs, 3d ed., p. 115.

Cases are recorded in which horses that were affected with pneumonia had two ounces of cantharides ointment rubbed into the side of the thorax within a period of twelve hours; copious diuresis ensued, and great thirst, and in these horses the gait became tottering, they could no longer stand on their hind legs, fell down, and remained immoveable.[1] Veterinary surgeons have observed the coexistence of paraplegia and nephritis, and the coincident cessation of both diseases on the application of antiphlogistic remedies.[2] Among the observations in the range of human pathology, those possess a critical value in which the disease commenced in the urinary organs, *e.g.* in gonorrhœa. Such an one is the fifth case published by Mr. Stanley:[3] in a young man, aged 22, ischuria resulted from a violent attack of gonorrhœa being arrested by injections, and at the same time paralysis of the sphincter ani supervened, with a diminution of motility in the lower extremities. The pulse was 120, quick and hard, the abdomen, especially in the hypogastric region, tense, distended, and tender to the touch. The pain extended upwards from the bladder to the left kidney, and then across to its fellow. The legs became remarkably flaccid, and completely paralysed; it was only in the thigh that some sensation remained. Enuresis took place; the urine discharged from the bladder was dark, fetid, and mixed with mucus. The tongue became dry, and death ensued from decubitus and complete retention of urine. The kidneys were larger than usual, very soft, and much congested. Numerous small deposits of pus were found in the cortical and medullary tissues. The infundibula and calices were filled with pus and a thick viscid mucus. The mucous membrane of the bladder was very vascular, and partly covered with plastic lymph. The brain and spinal cord were perfectly normal. In these patients the disease was complicated with disease of the bladder, in other cases the latter is found exclusively affected.[1] In the first volume of the 'Veterinarian' (p. 81), we find a case of paraplegia which was caused by an enormous distension of the urinary bladder, brought on by a calculus.

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[1] Magazin für die gesammte Thierheilkunde, herausgegeben von Gurlt und Hertwig, vol. iii, p. 355.

[2] Loc. cit., vol. ii, p. 108; and vol. iv, p. 435.

[3] On Irritation of the Spinal Cord, and its Nerves in connection with disease in the Kidneys, Medico-Chir. Transact., 1833, vol. xviii, p. 260.—See also Bright's Medical Reports, vol. ii, pt. i, p. 380.

Occasionally, paraplegia supervenes upon renal disease shortly before the occurrence of the fatal issue, without any derangement of the cerebral functions; in such cases we cannot attribute the effect to a disintegration of the blood, to which in others it may be set down. Mr. Stanley gives the case of a man, aged 30, who suffered from gonorrhœa and phimosis; the inflammation had subsided but the discharge continued. Suddenly paraplegia supervened, with loss of sensibility extending up to the navel. A few days previously, the patient had complained of pains in the lumbar region. The urine passed off involuntarily and in large quantities, and three pints were also drawn off by the catheter. Death ensued suddenly sixteen hours after the occurrence of the paraplegia. There was trifling congestion of the membranes and substance of the lumbar portion of the spinal cord, and a few drachms of clear fluid were found in the spinal canal. The liver was enlarged and indurated; both kidneys were so much filled with blood that they looked almost black; even the mucous membrane of the infundibula and calyx presented a black colour. The membranes of the ureters and the mucous coat of the bladder were more vascular than usual. The following case, which occurred in the clinical wards at Göttingen, and to which my attention was drawn by a talented and zealous pupil, Dr. Müller, is a not inappropriate illustration of the subject under consideration; I owe the details to the kindness of Professor Fuchs:

G. K., a man who had always formerly enjoyed good health, and of robust constitution, aged 43, had for a year been affected with a firm hard tumour of the left testicle, which, in the course of a twelvemonth, had attained the size of a child's head. The spermatic cord was also swollen and indurated. Pain occurred in paroxysms, and ascended from the testicle to the renal plexus. The general health of the patient had suffered, the tongue was furred, he complained of a bitter taste, and the bowels were costive. In spite of the narcotic remedies exhibited, the pains increased, especially at night; they settled in the region of the kidneys and descended to the scrotum. A hard nodulated tumour now became perceptible in the left hypochondrium. It was very tender to the touch, not moveable, about two inches in diameter, and as gentle percussion gave a dull and more forcible percussion a clear sound, it appeared to proceed from the anterior wall of the fundus ventriculi. This tumour, which rapidly extended forwards, reaching into the scrobiculus cordis, soon became the seat of violent, lacerating, and constringing pains, which occurred at the same time with those shooting from the back, and often terminated with extreme anxiety, dyspnœa, and general perspiration. The difficulty of walking increased, because every firm step induced fresh attacks of pain in both hypochondria. From the commencement of August, 1843, the pains and the gradual increase of debility confined the patient to his bed, and rendered the slightest movement of the trunk almost impossible. The pains in the tumour of the testicle had increased. On the 16th of August the patient complained that since midnight he had experienced creeping and formication in his feet, which had gradually ascended, and that his legs now felt as if they had gone to sleep. Sensation was lessened in the lower extremities; he was able to move them, but with difficulty. In the evening the legs had entirely lost their sensibility and motility; the anæsthesia extended over the abdominal parietes to the tumour and the false ribs. The temperature was not reduced, and was maintained to the last moment. The pain which had hitherto tortured the patient ceased from this time; except that movement of the trunk, deep inspiration, and pressure, induced it in a slight degree in the region of the stomach. Shortly before the paralysis supervened vomiting had occurred, which returned once or twice daily, after being preceded by nausea. The appetite disappeared, while thirst and dryness of the mouth and œsophagus increased. The excrements were voided involuntarily, and the urine had to be drawn off several times daily by the catheter. The feet became œdematous. The intellect remained unclouded. The voice became faint and hoarse, respiration slow, often intermittent, and during the last two days the expectoration was bloody. A few times formication occurred in the arms. Death resulted from pulmonary paralysis: the cadaveric inspection was instituted fifteen hours later. The right lung proved to be healthy, excepting a slight congestion; the left lung was pushed upwards, adherent to the pleura by old adhesions, full of blood and splenified below. A considerable quantity of fluid was found in the pericardium, the heart was exsanguine, but otherwise normal. The left testicle, after being detached from its envelopes, proved to be converted into a hard degenerated mass, four inches long by three broad. The epididymis could be recognised, the spermatic cord was thickened. Above the testicle a hydrocele had formed in the tunica vaginalis testis, containing about six ounces of yellowish fluid; on opening the abdominal cavity, the abnormal position of the intestines became at once apparent; the stomach was so much pushed up that only its pyloric end remained visible; the transverse colon had quitted the posterior margin of the stomach and lay quite free under the latter, attached to it only by the meso-colon. The small intestines were pushed over to the right. On introducing the hand into the abdomen a large tumour was found to the right of the spinal column. The stomach was much enlarged, forced up under the ribs, and distended with gaseous contents and a black fluid; on removing it with the small intestines, which were also much distended, and which pushed the ascending colon that was adherent to the fungous mass to the left side, the liver was found to be very large, the spleen very much elongated but soft, the right kidney rather large and presenting venous congestion, the bladder much enlarged, distended with urine, and its coats thickened, and the pancreas healthy, though adherent to the tumour. The latter appeared as a light-coloured rather soft mass, of the size of a child's head, and was connected inferiorly with the spermatic cord which was beset with numerous small masses of the same kind; the tumour adhered to the spinal column, enveloped the left kidney, which was atrophied and pale, and the abdominal aorta; it was separated with much difficulty from the first four lumbar vertebræ. The vertebræ themselves were neither rough to the touch nor altered in structure. The bodies of the five lumbar vertebræ were next removed by the aid of a chisel, and the spinal cord exposed, but with the exception of a trifling congestion of the dura mater, nothing abnormal was discovered. The following is the account of the appearance of the testicle and epididymis. The testicle, on being cut through, showed no trace of its original structure, and appeared as a tolerably dense mass, which in some parts presented a yellowish and fatty, in others a sanguineous and reddish texture; it felt uniformly soft and not granular; under the microscope it was seen to consist of irregularly-shaped cells with granular contents, surrounded by fat globules and minute granular molecules, but without caudate cells. The entire mass weighed about fourteen ounces. The tumour in the abdomen had all the characters of genuine encephaloid disease; it felt soft, and on incision melted down to a light red soft mass, feeling like fat; under the microscope it exhibited the same irregular cells and nuclei, as found in the testicle, and a cellular tissue constituting the stroma of the morbid growth.

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[1] Stokes; über die Heilung der Nerven-Krankheiten, edited in German by Behrend, 2d ed., p. 213.

I have myself had a man under my hands for a considerable time, whose disease commenced with hæmaturia, upon which subsequently a sense of oppression, weakness in the inferior extremities, and a violent lacerating pain in the thoracic and lumbar vertebræ supervened, which was not increased by external contact. During the last three weeks complete paraplegia had become developed, accompanied by paralysis of the bladder; sopor, delirium, and convulsions, which also involved the paralysed limbs, followed, and terminated in death. Professor Schlemm had the kindness to examine the brain and spinal cord; with the exception of an incrustation of a few cerebral arteries and an accumulation of serous fluid in the ventricles, no abnormity whatever was discovered; nor were the membranes or the osseous envelopes any way affected. The left ventricle of the heart was hypertrophied. Unfortunately the kidneys were overlooked, as I was unable to wait till the conclusion of the post-mortem.

Finally, I may be allowed to adduce the results of treatment in support of the doctrine of a connection existing between diseases of the urinary organs and paraplegia. In a case of dysuria, stricture of the urethra, and paraplegia, published by Dr. Graves,[1] manifest improvement followed the first introduction of a bougie; the cure was achieved by warm baths, frictions, &c. The praise bestowed upon cantharides, the ethereal oil of turpentine, and Peruvian balsam, as remedies

[1] A System of Clinical Medicine, p. 408.

against paralytic affections, may with some justice be referred to cases of this description.

3. *Paralysis depending upon the Affections of the Sexual Organs.*—The female sex offers peculiar opportunities for the study of paralytic uterus connected with morbid conditions of the sexual system; they arise either from direct pressure of the distended uterus or ovary upon the nervous plexuses of the lower extremities, and are then only unilateral and accompanied by derangement of sensibility, as pain, numbness, or loss of sensation,[1] or they are caused by a reflex influence upon the spinal cord, and then affect both sides of the body. Veterinary surgeons have repeatedly met with the complication of paraplegia and metritis; Gellé[2] quotes eleven cases of acute metritis in cows, which had followed calving; in all, the power of moving the hind legs was diminished, while sensibility continued unimpaired. Sewell[3] publishes the sectio cadaveris of a cow attacked with paraplegia following calving; intense inflammation was found in the uterus and vagina. Ithen[4] has communicated a few cases of metritis in horses, which was accompanied by inability to stand and to raise themselves on their hind legs. Dr. Hunt[5] has observed similar occurrences

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[1] In the month of February of the present year (1851), a woman, aged 33, applied in the Policlinique, who on the 25th of January had been delivered of her third child, by the forceps, after a heavy labour, which lasted twelve hours. During parturition she suffered from painful spasms of the left leg, and on the following and subsequent days, after she had left her bed, complained of lassitude, difficulty in walking, and diminished sensibility of the left foot. The examination showed that the sensibility of the left thigh and leg was normal, but that it was deadened on the dorsum and in the sole of the foot, so that the patient could not distinctly feel the hand when passed over it, or the ground when she put down her foot. The diminution of motility was betrayed by a laborious dragging of the leg in walking, and by the difficulty with which she executed all the movements. The veins were varicose, the uterus had remained prolapsed after delivery. A purgative was ordered, followed by friction with oil of turpentine, and the internal exhibition of the spirituous extract of nux vomica, commencing with half a grain, and increased to one grain, three times a day. The result was so completely satisfactory, that the motility and sensibility were entirely restored, and on the 3d of March the patient was discharged cured.

[2] Journal Pratique, &c., 1826.

[3] Veterinarian, vol. iv, p. 509.

[4] Nebel und Vix; Zeitschrift für die gesammte Thierheilkunde, vol. iii.

[5] See Stanley; loc. cit., p. 274.

in women. Lisfranc[1] details the case of a lady, aged 36, who had gradually been attacked with paraplegia, without any loss of sensibility. All the remedies applied on the assumption of a disease of the spinal cord, remained unavailing. Lisfranc made a vaginal examination, and found the fundus uteri so much enlarged as almost to fill the pelvis; after using the iodide of potassium and iodine frictions for three months, and taking the waters at Barège, the tumefaction of the uterus was reduced, and complete recovery was obtained in two years. Paralysis of the lower extremities often supervenes during the confinement, and even after easy births, without pain having preceded or being associated with it; and the accoucheurs attribute it to compression of the sciatic plexus and the obturator nerve, for which there is no warrant whatever. There would be more justice in assuming that an accumulation of serous fluid had taken place in the spinal canal, resulting from disturbance of the circulation, as we find in tumours of the abdominal cavity; but morbid anatomy does not afford any proofs of the fact. No such condition, however, is necessary as demonstrated by a case which recently came to my notice, and in which the uterus was atrophied. A woman, aged 41, had since the cessation of her catamenia, six years previously, frequently suffered from twitchings of the inferior extremities, and for nine months past motility had been diminished; there was a frequent tremor and sense of weight in the legs. The cutaneous sense of touch was dull in the feet, especially in the left, in which the disease had commenced with lacerating pains. Retention of urine alternated with enuresis, especially at night. The upper extremities continued in the full possession of their vigour. No abnormity was discoverable in the spinal cord. Dr. Schöller, whose accurate method of exploration is well known, found that the vagina was much shortened and that there was no portio vaginalis; only the transverse fissure of the uterus remained visible at the arch of the vagina directed from before backwards. The os tincæ was very soft, and the neck presented the usual hardness; it was evident that the sexual system had undergone a process of involution, as in an old woman. I ordered the alkaloid of the nux vomica, strychnine, in doses of a quarter of a grain twice a day, and friction of the legs with the ethereal oil of turpentine; after continuing this treatment for three weeks, a favorable effect was experienced. The difficulty of micturition ceased, and a remarkable improvement in the gait was manifested. The tonic effects of the strychnine rendered it necessary to omit it for a time. The patient still continues under treatment.

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[1] Journal de l'Anatomie, de la Physiologie, et de la Pathologie du Système Nerveux; Paris, 1843, vol. i, p. 154.

The hysterical form of paralysis belongs to the present chapter. In the description of hysteria, which is a reflex-neurosis proceeding from the genital system, I have pointed out that the paroxysms are characterised not only by the sudden transitions of the convulsions, with regard both to their seat and degree, but also by the instantaneous exchange of one condition for that diametrically opposite; thus we see an excess of motility and sensibility pass rapidly into immobility and obtuseness, and profuse discharges replaced by an arrest of secretion. This reflex inactivity and the paralytic symptoms by which it is marked, are either of an evanescent character, or they are periodical or persistent. In the first case, the paralysis is manifested during or after the attack, and may assume the various forms of paraplegia, hemiplegia, paralysis of single parts, as the hand, the foot, the larynx, or the bladder; the same form may persist or the affection may present various phases, and be accompanied with numbness, anæsthesia, and formication; the attack itself is of brief duration. This variety of paralysis closely resembles that occurring after epileptic paroxysms, (page 201.) On account of its periodical character it is allied to intermittent paralysis, a disease of such rare occurrence, that I am induced to quote the following instance:

In the month of April in 1830, I was called to a lady, aged 64, who, after having been in good health on the previous day, was suddenly attacked with paralysis of the lower extremities, with an involuntary discharge of urine and fæces. When lifted out of bed she was unable either to stand alone or to walk even a few steps, but instantly sank down. Sensibility was unimpaired, the intellect was clear, the temperature of the skin cool, the pulse 80, small and empty, breathing normal. She uttered no complaint of pain in the spine. Being unable to ascertain any definite cause to which the malady could be attributed, I ordered the application of sixteen cupping-glasses along the vertebral column, a blister in the lumbar region, and internally an infusion of arnica, with the liq. ammoniæ vinosus;[1] at the same time I did not conceal my apprehensions from the relatives, that I anticipated a fatal issue. I was surprised by the great alteration which I found on the following day; the patient came to meet me, led by her daughter, still complaining of weakness in the legs, and able to discharge her urine at will. She had not as yet had an evacuation from the bowels. The morning after, however, entirely clouded my joy at the sudden efficacy of the remedies employed; all the symptoms had recurred that alarmed me two days previously; the character of the paralysis was now clearly manifested, and the prevalence of intermittent fevers at the time helped to confirm the diagnosis. To avoid all error I determined to await the third paroxysm, and it did not fail to take place at the proper time, though this time unaccompanied by paralysis of the sphincters of the bladder or rectum. I now ordered three grains of the sulphate of quina to be taken every two hours; and after the intermission of two paroxysms, bark in substance was exhibited for several weeks. I have since attended the same lady for another affection, and she has not suffered again from debility of the legs, or from any other paralytic affection.

In some cases the hysterical paralysis is persistent, serving in a measure as a substitute for the other symptoms of the disease, which cease during its continuance. The peculiar psychical relations are as remarkable in this as in other hysterical affections; there is irresolution, amounting at times to an utter prostration of the powers of the will, and an inability to offer any moral resistance; the patient yields to and is overcome by every impression. This trait is so characteristic, that an accurate observer[2] has been induced to assert that, in hysterical paralysis, the muscles are not incompetent to follow the impulse of the will, but that they are merely immoveable from the will not being exercised. There is no other paralytic affection upon which psychical impressions, as faith and superstition, joy or fear, exert so marked an influence. But a favorable change may occur suddenly and spontaneously, as is often the case in hysterical affections, and this is attributed inconsiderately to agents possessing no power, such as homœopathic remedies. The prognosis of this affection is satisfactory both to the patient and the physician; even if it lasts a considerable time, nutrition does not suffer, and the sphincters continue in the possession of their functions. This must not be forgotten in the treatment; violent and energetic treatment (such as moxæ or issues) should be avoided. As regards the moral treatment, I refer to what has been stated at page 90. The peripheral nerves should be roused by friction, by stimulant and aromatic infusions injected into the vagina, suppositories of castoreum, &c. The preparations of nux vomica are as well suited to hysterical as to other forms of paralysis. The warm baths of Ems, taken at the temperature suited to the irritability of the individual, together with the vaginal douche, are much to be recommended. I have had an hysterical lady under my care, who, after having been paraplegic for a year and a half, was in a short time restored to health at Ems by the excellent management of the late Dr. Diel. In an anæmic condition, chalybeate baths are indicated; Dr. Brück[1] found the waters of Driburg more efficacious in hysterical paralysis of the lower extremities, than in any other symptom of hysteria.

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[1] [Liquor ammoniæ vinosus is composed of one part of liquor ammoniæ to two parts of spiritus vini rectificatissimus.]—Ed.

[2] Brodie; Lectures illustrative of certain Local Nervous Affections, p. 48.

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[1] See the admirable Treatise by Dr. Brück; Das Bad Driburg in seinen Heilwirkungen dargestellt, 1844, p. 94.—Brandis; Erfahrungen über die Wirkung der Eisenmittel im Allgemeinen und des Driburger Wassers insbesondere, 1803, pp. 150—172. And—Lentin's Geschichte der Eisengranulirbäderm Harze, in dessen Beiträgen zur ausübenden Arzneiwissenschaft, vol. i, 2d ed., p. 71.

[Driburg is a small watering-place in Westphalia; the principal constituents of its waters are salts of soda, lime, and iron.]—Ed.

CHAPTER XLIX.

TABES DORSALIS.

The spinal cord viewed as a central organ, not only serves as an agent for the mutual transmission of stimuli, but also as a source of nervous power, of the principle of motor and sensory tension, by which the continuance and vigour of motion and sensation is secured, and a general stimulus for the entire organism provided. The disease, which is characterised by a diminution of this power, is termed tabes dorsalis.

The first symptom by which it is manifested is reduction of the motor power in the muscles, first and foremost in the inferior extremities; at the commencement one leg may be affected more than the other, but in the progress of the disease both suffer. The patient complains of weakness and inability to perform any movement or endure any position for a continuance. If he is required to attempt any act demanding a larger consumption of motor power, *e.g.* to bend down or to stand on one foot, his strength at once fails; the practised rider is unable to hold on to his horse as long as usual. Early in the disease we find the sense of touch and the muscular sense diminished, while the sensibility of the skin is unaltered in reference to temperature and painful impressions. The feet feel numbed in standing, walking, or lying down, and the patient has the sensation as if they were covered with a fur; the resistance of the ground is not felt as usual, its cohesion seems diminished, and the patient has a sensation as if the sole of his foot were in contact with wool, soft sand, or a bladder filled with water. The rider no longer feels the resistance of the stirrup, and has the strap put up a hole or two. The gait begins to be insecure, and the patient attempts to improve it by making a greater effort of the will; as he does not feel the tread to be firm, he puts down his heels with greater force. From the commencement of the disease the individual keeps his eyes on his feet to prevent his movements from becoming still more unsteady. If he is ordered to close his eyes while in the erect posture, he at once commences to totter and swing from side to side; the insecurity of his gait also exhibits itself more in the dark. It is now ten years since I pointed out this pathognomonic sign, and it is a symptom which I have not observed in other paralyses, nor in uncomplicated amaurosis; since then I have found it in a considerable number of patients, from far and near, who have applied for my advice; in no case have I found it wanting. Some patients mention the circumstance without being asked about it; one gentleman, a foreigner, whose eyesight was unimpaired, told me that he was at present unable to wash himself in his dark bedroom while standing; and that if he wished to keep his balance he was obliged to have a light while performing his toilet. Another, whose business rendered it necessary for him to go out at six o'clock in the morning, complained that he required some one to support him in the house and out of doors, but that he could dispense with assistance in full daylight.

Independently of this peculiarity, there is also a difference in the movements themselves; the patient experiences a greater difficulty in executing forced and limited movements, than those in which he merely follows the impulse of his inclinations; he finds it much more laborious to walk slowly with a measured step in a given direction, than to let his feet take their own course; rising from the chair, or going up stairs, is more difficult than sitting down or descending; the most difficult matter is to turn round in walking. After prolonged rest, walking and standing are more laborious and insecure than when once begun. The loss of muscular power is also manifested in organs provided with a sphincter, and especially in the bladder. At the commencement of the disease, the desire to micturate occurs more frequently, and cannot be gratified soon enough, for the patient is unable to retain his urine till the utensil is brought to him. Enuresis not unfrequently occurs during sleep. The urine is not discharged in an arched jet, as in health, but falls more perpendicularly; nor is the bladder entirely emptied. Costiveness prevails almost universally; the patient feels that he is unable to strain as long and as forcibly as before. Painful sensations of different kinds almost invariably accompany the affection; the most common is a sense of constriction, which proceeds from the dorsal or lumbar vertebræ, encircles the trunk like a hoop, and not unfrequently renders breathing laborious. Several of my patients have described this sensation as particularly troublesome during sleep, causing them suddenly to start up and scream out. Others complain of a heavy weight pressing upon the rectum and the bladder, others again of colic and gastric pains; the majority suffer from pain shooting through the legs, and a sense of pricking, itching, burning, or cold in the skin of the lower as well as of the upper extremities; the face alone is an exception. Formication very rarely occurs in the back. These symptoms may endure for a considerable time, and at first they attract little attention. After an uncertain period the weakness of the legs diminishes visibly. The patient, owing to the threatening loss of balance, is obliged to evert his feet, and walk with his legs apart; he leaves his heels as long as possible in contact with the ground, and keeps his knees bent; he is still able to propel himself, (one of my patients stated to me, that he found it necessary to think of every one of his movements,) and to totter along the streets, but if arrested in his progress, he is unable to stand still without clinging to some support. The patient's own strength soon fails to support him, and he is obliged to have recourse to assistance. The necessity of employing his eyes becomes more and more urgent; if he closes his eyes, even while sitting, his body begins to sway to and fro; in one case the patient was unable to maintain himself erect in his chair, and slid down to the ground; when in an horizontal posture, the patient is no longer able to recognise the position of his own limbs, and cannot tell whether the right leg is crossed over the left or the reverse. A foreigner, who was a patient of mine, told me that in visiting the diorama he had not the slightest sensation of his progression when led from the light to the dark department. The condition of these unfortunate individuals is rendered the more distressing by the circumstances that amblyopia often supervenes; in many cases it is associated with the disease from the commencement. Even when the optic nerve was not implicated, I have repeatedly found a change in the pupils of one or both eyes, consisting in a contraction with loss of motion, which in one case, that of a man aged 45, attained to such a height that the pupils were reduced to the size of a pin's head. In one case, where there was no cerebral affection, a strabismus towards the inner angle took place, the patient at the same time being able to move his eye outwards at will. As the disease progresses, the loss of power also extends to the superior extremities, though they are not affected to the same degree as the inferior. The sphincter of the bladder becomes completely paralysed; erections cease, and the virile power becomes extinct. The intellect of these patients generally remains unimpaired; the majority do not complain much, and they are inclined to represent their condition, especially to the medical man, in a too favorable light; if they are members of the higher classes, they anxiously endeavour to conceal their loss of motor power, in order to avoid the evil reputation of being affected with tabes dorsalis. Nutrition is not impaired in a measure corresponding to the diminution of motor and sensory power. Such patients may even retain their embonpoint for a considerable time, so that the term tabes does not apply to this feature. At a later period the muscles become flaccid and atrophied, especially about the nates, the legs, and the back. Towards the termination of the disease the patient becomes utterly incapable of holding himself erect or moving; still he continues able to execute movements with his feet at will when the trunk is supported. Diuresis alternates with ischuria; the fæces pass off involuntarily. Gangrene at the sacrum and trochanters, accompanied by febricitations, ushers in death.

Tabes dorsalis is a chronic disease, which may extend over several—as many as ten and fifteen—years. It is only shortened by complication with other more rapidly fatal diseases, especially pulmonary and intestinal phthisis. Intercurrent diseases may also accelerate its progress.

Although the post-mortem records of this disease may present considerable variations, they almost without exception show the existence of partial atrophy of the spinal cord; the lumbar portion and the nerves given off from it are the parts generally affected. The loss of substance, which may amount to one half or two thirds of the healthy spinal cord, either affects the grey and the white substance, or only one of them. It would be well always to have a fresh, healthy specimen at hand for the sake of comparison, and to render the examination more satisfactory. As yet we possess no microscopic investigation of the atrophied portion. The contents of the cords of the cauda equina have often been found to have disappeared to such an extent that nothing but the empty nurilemmatous sheaths seemed to remain. The roots of nerves inserted at a higher segment of the cord also suffer from atrophy; and it is a point of especial interest to observe that the posterior, sensory roots, are occasionally alone affected in conjunction with the posterior columns of the spinal cord, the anterior motor columns and nerves retaining their normal structure. A remarkable instance of this occurred to me in the person of a medical practitioner of a provincial town, of 52 years of age; after violent emotions and severe colds, caught in the prosecution of his profession, he had in his fortieth year been attacked with partial paralysis of the lower extremities and amblyopia, for which, at the suggestion of myself and the late Professor Rust, he went through a course of the Marienbad waters, but to no purpose; the amblyopia passed into complete amaurosis, and tabes dorsalis became fully developed in spite of all the remedies employed. I did not see the patient again; but I ascertained that the insensibility of the skin was maintained to the last and that he correctly appreciated variations of temperature. I was present at the post-mortem examination which was made by Professor Froriep, and the spinal cord, compared with the fresh cord of a man of the same age, only amounted to two thirds of its normal size; I was not a little surprised to find that the atrophy was confined to the lower part of the posterior columns and nerves. The medullary tissue of the former had almost entirely disappeared, so that they were translucent, and of a greyish-yellow colour. The posterior roots of the nerves were deprived of their nerve matter, and presented a watery appearance. From the middle of the dorsal nerves upwards, the atrophy passed into a healthy condition. The anterior columns and roots of the nerves presented no abnormity. Froriep has observed the same in another case of tabes dorsalis. When the disease has been accompanied by amaurosis, we almost invariably find the optic nerve, the chiasma, and the optic tracts atrophied; one or both optic thalami are also either atrophied, or they exhibit changes of texture and colour. The other morbid changes found in tabes dorsalis vary; sometimes the white substance presents a coriaceous condensation, but it is more usual to find softening of the grey matter. In 1832, I examined a man, aged 42, who had been under my care for three years for tabes dorsalis, and found the lumbar, the cervical, and a portion of the dorsal region of the cord of an almost fluid consistency; it was traversed by a number of white longitudinal fibres, as if a delicate cauda equina passed through the cord. The meninges rarely retain their healthy condition; the arachnoid is thickened and beset with cartilaginous and osseous plates, and contains more or less serum. It is exceptional to meet with morbid changes in the osseous envelopes.

Two circumstances that have been shown with certainty to predispose to tabes dorsalis are the male sex and the period between the thirtieth and fiftieth year of life. Scarcely one eighth of the cases are females. The loss of semem has always been looked upon as one of the most fruitful sources of the complaint; but this in itself does not appear to be a matter of much consequence as influencing the disease, as patients who have been labouring under spermatorrhœa for a series of years, are much more liable to hypochondriasis and cerebral affection than to tabes dorsalis; but when combined with hyperstimulation of the nerves to which sensual abuses give rise, it not unfrequently favours the origin and encourages the development of the disease after it has commenced. When the strength is much taxed by continued standing in a bent posture, by forced marches, and the catarrhal influences of wet bivouacs, followed by drunkenness and debauchery, as is so often the case in campaigns, the malady is rife; this is the reason why tabes dorsalis was so frequent during the first decennia following the great wars of the present century. Rheumatism appears to be the morbid process which most frequently gives rise to it. The cases are not rare in which the most careful examination fails to establish an exciting cause.

There is no prospect of recovery for patients of this class; the fatal issue is unavoidable; the only consolation that can be offered to those fond of existence is the long continuance of the disease. If in any case the busy activity of the physician increases the sufferings of the patient, it is in tabes dorsalis. When one of these unfortunate individuals presents himself to us, we generally find his back seamed with cicatrices, he brings us a heap of prescriptions, and gives a long list of the watering-places he has visited in search of health. It is but common humanity to inform him at once that therapeutic interference can only injure, and that nothing but the regulation of his diet can retard the calamitous issue. Every unnecessary tax made upon the motor powers, as well as sexual excitement, ought to be strictly prohibited. The best remedy for the obstinate costiveness is to be found in cold water enemata; the careful use of cold water in washing the trunk and spinal cord, and in the shape of affusion to the latter, may be recommended. I have employed an ointment containing veratrine with benefit against the painful sensations in the back and extremities. The thing most to be avoided is the frequent application of cupping and issues; nor are long journeys to watering-places advisable, because the driving itself is injurious, and the baths will only afford temporary relief, which will disappear on the return of the patient. Incurable patients should be allowed to spend their lives quietly in their family circle, that their last moments may be soothed by the fond cares of those whom they love.

CHAPTER L.

CEREBRAL PARALYSES.

In no other department of neuropathology is the absence of critical judgment so much felt as in the doctrine of cerebral affections; nor have unfounded opinions, errors, and even falsehoods anywhere met with so facile a reception as in this case. When we turn to the study of paralysis depending upon the brain, we find all the authors committing the same error in not distinguishing between the nerve fibres that pass off at the brain, and those which terminate within it. The former only form the first stage of the peripheral tract, and are without exception subject to the law of conduction on the same side; this has been overlooked, and the consequence has been that all diseases occurring within the cranium have been looked upon as affecting the brain as a central organ; this accounts for the uncertainty which prevails even among physiologists regarding the decussation or non-decussation of cerebral conduction. But these states are of sufficient importance in point of diagnosis and therapeutics, to merit a separate consideration, though they have often been cursorily alluded to in the preceding chapters. In addition to the physiological criterium of loss of the conducting power on the side of the injury, the paralysis of the nerves adjoining the brain and within the brain may be distinguished by the relations of time and situation. If in the former case the seat of the injury is limited, we shall find single cerebral nerves affected and generally throughout their distribution; or if the injury is more extensive, the adjoining nerves are involved according to their contiguity from before or from behind, and either temporarily or permanently. In the majority of instances this takes place in a regular succession, slowly in the case of tumours, or more rapidly when exudation or hæmorrhage has occurred. To central paralysis on the other hand we may apply the physiological law of conduction in a crucial direction, and it is diagnosed by the coexistent affection of other nerves, both sensory and motor; not only the nerves of the head, but also those of the tongue and the extremities, lose their power of conduction. It is also a characteristic circumstance that the nerve is rarely entirely affected; some of its fibres generally remain exempt from the paralysis.

The exciting causes generally act by inducing compression, with or without irritation. The cranial bones at the basis of the brain and the periosteum are frequently at fault; the latter has not hitherto met with the attention it deserved, although the periostitis of the surface, which is more accessible, might have served to direct attention to the subject. It is here that the dyscrasiæ take root, as we see in syphilitic, mercurial, scrofulous and rheumatic cachexiæ; the gouty diathesis rarely manifests itself in this quarter. In these cases the paralysis is accompanied by the symptoms peculiar to the constitutional affection, as for instance in syphilitic nodes, the agonising pains that torture the patient at night. The recovery of the patient depends more upon the correct diagnosis in this than in any other kind of paralysis; and it is dangerous to confound these forms with apoplectic conditions of a central origin. The specific remedies, mercury and iodide of potassium, prove invaluable in these cases, but we must be careful not to continue their use too long. The Decoctum Zittmanni may be appropriately exhibited here. Among several cases of the kind which I have among my notes, I may quote the last, which occurred in a man upwards of 50 years of age, who after suffering repeatedly from chancres of the glans penis, began in April 1844 to complain of loss of sensation in the right upper lip, which gradually extended over the corresponding half of the chin, the right cheek, ear, and forehead. The right half of the tongue and the mucous membrane of the mouth also became affected with anæsthesia; the teeth on the same side felt as if invested with a thick mucous covering. The power of mastication ceased on the right side. Strabismus internus ensued; the patient was unable to move the right eye outwards. Ptosis and immobility of the right pupil followed next. Four weeks after the commencement of the disease, the right half of the face became the seat of pain, which increased in violence towards evening, and attained such a pitch that the patient could not sleep for 65 nights. Great emaciation and debility ensued. All the remedies employed were fruitless; the only thing that afforded even momentary relief was washing and pouring water over the head and face. In the month of

July the patient applied to me for advice; I did not agree with the view taken by other medical men as to the affection being central and incurable; but believing the disease to be syphilitic periostitis of the sphenoid bone, I recommended a course of mercurial inunction and starvation, which the patient commenced on his return home and continued for four weeks. Salivation did not occur. The pains were diminished to such an extent that the patient again enjoyed as sound sleep as he had in former days. In September the ptosis yielded. In January I again saw the patient and presented him to the gentlemen who attended my clinical lectures. The local symptoms as well as the general health of the patient were already much improved. The ptosis had entirely disappeared; the abducens had, though not entirely, recovered its conducting power, the pupil contracted normally, and only the fifth nerve continued affected. Sensation had returned in the lower part of the right half of the face; the remaining parts continued numbed, and there was still a variety of abnormal sensations, such as pricking, formication, itching, and tension. Though the face was insensible to the touch, it was very sensitive to heat and cold; in drinking a hot beverage the patient experienced a burning sensation not only in the upper lip, but also in the forehead. Although the surface of the eye exhibited little sensibility, when water of a temperature of 14° F. (—8° R. in orig.)[1] was applied, the eye seemed to be frozen. The muscles of mastication had not regained their functions. I was able to hold out a prospect of further amelioration to the patient from the internal and external administration of iodide of potassium and a future repetition of the course of mercurial inunction.

Morbid growths at the base of the brain and cranium frequently arrest the conduction of the nerves that pass off from there. They are generally tumours of a scirrhous and carcinomatous, rarely of a tubercular character; they more frequently occupy the anterior than the posterior part of the cranium, and owing to their indolent growth give rise to a slow succession of paralytic phenomena in the range of the adjoining nerves. Bell has given an instance which may serve as a model of clinical observation, and which has been rendered still more instructive in the last edition by the publication of the post-mortem.[1] The patient was wounded in the battle of Waterloo on his left temporal and zygomatic bone; five years later he received a kick from a horse on the same part. The following symptoms presented themselves successively: violent pain in the left cheek and forehead; ptosis of the left eyelid, and rigidity of the bulb and strabismus externus; next the bulb assumed a central position, and remained immoveable even when the eye was closed, and in winking, the left pupil became dilated and immoveable, the left half of the face anæsthetic, accompanied by agonising pain; masticatory paralysis of the same side and atrophy of the masseter and temporal muscle, histrionic paralysis of the left side, destructive inflammation of the eye, and ulceration of the cornea ensued. After a few months the facial paralysis ceased, while the painful anæsthesia continued until death. At the autopsy a considerable difference was found in the masseters of the two sides; the left temporal and masseter were pale, thin, and deprived of a large portion of their fibres, while the corresponding muscles of the opposite side presented double the size and a red colour. On raising the brain, adhesions of an older date were found at the left side of the sella turcica, between the dura mater and the membranes of the brain, which at this point presented a reddened appearance. On separating the adhesions, a tumour was exposed on the side of the sella turcica, over which the dura mater was stretched. The tumour thus occupied the entire cavernous sinus. It had a cheesy character, though its density was rather greater on account of an admixture of fibrous tissue. There was no difficulty in detaching the tumour from the bone, which was perfectly healthy in other respects, with the handle of the scalpel. The oculomotor, trochlear, trigeminus, and abducens nerves, were imbedded in the substance of the tumour. All these nerves between their origin from the brain and the tumour were of a pale grey colour, and were perceptibly diminished in size. The optic crossed the upper part of the tumour and also presented a dull grey colour, while the left optic was of a pearly white hue. In this case the oculomotor was the nerve first affected by the tumour, and owing to the integrity of the abducens the eye squinted outwards; when this nerve had also suffered from the compression, and all the ocular muscles had become paralysed, the bulb was rigidly fixed, and remained immoveable in the centre of the orbit. The temporary paralysis of the facial nerve showed, as was afterwards evidenced by the adhesions, that the inflammation had at one time extended to the origin of this nerve, but without affecting it permanently.

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[1] The context renders it probable that this is a misprint for 80° R., or 46° F.]—Ed.

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[1] The Nervous System, 3d ed., p. 264.

Among the tumours comprising the nerves at the base of the brain, we have also to mention aneurisms, a few instances of which have already been communicated.

In all these cases the succession of the paralytic symptoms is slow; they occur in rapid succession or even simultaneously, when sero-albuminous accumulations take place at the base of the brain. In meningitis we frequently have opportunities of seeing this; the extension of the paralysis affords a measure to determine the locality of the inflammation and exudation, which is most frequently found in the pentagonal space between the optic chiasma and the pons Varolii, beneath the arachnoid. If absorption takes place, then paralytic affections gradually cease, but not always in the order of contiguity.

Besides the morbid changes at the base of the brain, by which the nerves traversing it are deprived of their conducting power, there are also diseases of the central organ itself, which affect the nerves at their point of insertion into the medulla oblongata and brain, and consequently produce peripheral paralysis in addition to the phenomena of a cerebral affection. These cases are extremely difficult of recognition, and are generally interpreted erroneously. Thus Dr. Watson[1] met with a case in which there was complete facial paralysis with deafness on the right side, and the patient also suffered from headache, vertigo, a tottering gait, drowsiness, and delirium. A few days before death, sopor and contraction of both arms supervened. In the right hemisphere of the cerebrum there was a considerable tumour, of three inches in length by two broad, which exerted so much pressure as to cause the parietes of the right lateral ventricle to be in apposition. The right facial and acoustic nerves at the point where they leave the medulla oblongata, adhered to one another; the facial was harder and thicker than its fellow, the acoustic was soft, diffluent, and atrophic; immediately above the medulla oblongata, and in a line vertical to the insertion of the facial, a nipple-shaped process descended from the lower surface of the cerebrum, which compressed the two nerves, and appeared to have been formed in consequence of the pressure exerted by the large tumour.

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[1] Bell, The Nervous System of the Human Body, 3d ed., 1845, p. 304.

We find that tumours of the pons Varolii are peculiarly liable, not only to compress the nerves passing from and near it, but also to involve the adjoining medulla oblongata, and thus to induce paralysis of the extremities in a crucial direction. This peculiar combination of the paralytic symptoms in the facial nerves on the one hand, and of the nerves of the extremities on the other, allows our determining the seat of disease with some certainty during life. The following case, which has fallen under my observation, may serve as an illustration: Mr. B., a Pole, and student of philosophy, 23 years of age, and according to the statement of his friends always of weak mental powers, had become still more obtuse after a nervous fever which he had laboured under in January, 1840. In the middle of August, 1840, I was called to see him, and found that three weeks previously he had taken too much wine at a supper party, and in his intoxication had caught cold at the river side. On the following morning he felt a great weakness in the left arm and leg, and on looking at himself in the looking-glass, found that the right eye was turned towards the nose, and that he was unable to turn it outwards. His speech was hesitating. He hoped to get better by taking violent exercise, and by fatigue, and he tried to remove the clumsiness in walking by long promenades, but his condition was only rendered worse. I found that the sensory as well as the motor conducting power was diminished in the right half of the face and in the extremities of the left side. The right half of the forehead was only thrown into shallow folds as compared with the right; the right bulb was directed towards the nose, and the strongest effort of the will failed to turn it outwards, even when the left eye was closed. The strabismus was accompanied by double vision. The pupil was of normal size, and equally moveable with the one of the left eye. Vision was unimpaired; the eye of this side could be well opened, but not so firmly closed as the left; a fissure remained when the attempt was made. The sensibility of the right half of the face, though not extinguished, was obtuse. The patient himself observed that he felt the pricking of the skin on this side but faintly, while pricking the left cheek induced pain. This difference was scarcely perceptible in the nares, the sense of smell continuing unimpaired; nor was there any difference in the two sides of the tongue, both sides of which tasted equally well. During the later period of the disease I have not repeated these experiments, owing to the inability of the patient to give an accurate account of his sensations. The patient heard much less distinctly with the right than the left ear. The histrionic and masticatory movements of the muscles of the right side of the face were more indolent, and the left angle of the mouth was distorted in speaking. Articulation was performed very slowly, the tongue continuing perfectly moveable in every direction. The motility of the left arm was impaired, its sensibility normal. The pressure of this hand was powerless compared with that of the right; the patient could only raise his hand and fore arm to a certain height, and any movement of the upper arm was out of the question. He dragged the left foot in walking; there was no complaint of headache, though the point was particularly inquired after. The intellectual powers were depressed, and the sleep was sound. The pulse heavy, making seventy beats. The skin dry, the bowels gostive, and resisting even drastic remedies. The treatment proved of no avail. The bodily and mental powers failed more and more. During the last four weeks of life, a difficulty of deglutition supervened, which seemed to reside more on the left side, as the patient also himself stated. The torpor of the intestinal canal continued up to death, which ensued at the commencement of the month of October, 1840, preceded by profound sopor.

Previous to the autopsy, which was made by Dr. Böhm, I again, according to my custom, gave my reasons for the diagnosis which I had formed; the complication of paralysis of the left extremities, with a paralytic affection of the right side of the face, allowed me to assume a disease at the right base of the brain, involving the peripheral distribution of the nerves given off there. If the right hemisphere of the brain had been affected as a central organ, paralytic symptoms would have been manifested in the left half of the face, combined with paralysis of the left extremities; and in speaking the right angle of the mouth would have been distorted instead of the left. The phenomena presented during life suggested not only the seat of the injury, but also its extent. The anterior portion of the base of the brain was evidently uninjured as far as the fifth nerve. The olfactory, optic, oculomotor, and trochlear nerves, exhibited no derangement in their functions, for it was sufficiently evident that the direction of the bulb inwards did not depend upon spasmodic action of the oculomotor, from the inability of the patient to direct his eye outwards at will, even when the left eye was closed. From the region of the fifth the morbid changes which particularly involved the abducens evidently extended to beneath the upper portion of the medulla oblongata, as the right eye was turned inwards from the commencement, and as the left extremities were seized with paralysis. The greater difficulty was to form an opinion of the nature of the disorganisation. The symptoms showed that some cerebral nerves were more compressed than others, indicating an unequal volume, yet there were no features by which the exact nature of the disease could be determined. Neither the experience of others nor my own afforded an instance of hæmorrhage at the base of the brain, after which the patient survived for ten weeks with so extensive a residuary affection; nor could I assume the affection to consist in softening and suppuration, because, independently of their rarely occurring at the base of the brain, several of the symptoms characterising them were absent, especially pain, convulsive seizures, and alternations of remission and exacerbation. It appeared to me more probable that we had to do with a morbid growth of a fungous character, although even in this case the absence of pain was difficult to be accounted for, owing to the vicinity of sensitive portions of the brain and sensory nerves. After opening the cranium we found great congestion of the surface, and in the interior of the cerebrum; albuminous exudation between the arachnoid and pia mater, and in the vicinity of the sylvian fissure, some serum in the ventricles, while the medullary substance was of a firm consistency. At the base of the brain a large tumour was at once seen, which on removal proved to be seated in the right half of the pons Varolii; this had attained double its ordinary size, and projected beyond the anterior margin of the left half by an inch, extended posteriorly under the right olivary body, and had thus produced a considerable displacement of the different parts of the brain and the nerves. The left half of the pons and the medulla oblongata, as well as the abducens of the right side, were most altered in shape and position; the right trigeminus, the facial and acoustic nerves, had also suffered, but less.[1] In order not to damage the preparation, which I presented to the anatomical museum in Berlin, only one incision was made into the tumour of the pons Varolii, and it proved to be formed by a large coagulum, which was disposed in layers like the contents of old aneurismatic tumours.

Longet[2] has described a case closely resembling the one just detailed in its symptoms, in which the pons Varolii contained a scirrhous tumour in its left half. Similar observations have been recorded by Abercrombie and Bright.[3] The following case of an older date, for which we are indebted to Yelloly, deserves to be recorded here.[4] The patient, a man aged 36, had for a twelvemonth been subject to violent pains darting from the occiput to the forehead. On awaking one morning he found that he had double vision, and that his left eye was turned inwards; a few days after the right hand became weak and the left leg numbed. Speech was impeded and stammering, the mouth distorted, the pulse indolent, beating sixty-eight times in the minute, and weaker on the paralysed than on the healthy side. The pupil of the left eye, which was turned towards the nose, contracted on the stimulus of light. The patient retained no control over the external rectus, nor did the bulb, as is usual in strabismus, recover its proper position on closing the healthy eye. Eight days later convulsions of the entire body supervened, with loss of consciousness, and after twenty-four hours death ensued. A few hours before the fatal issue, the pupils became insensible to light, and the left bulb resumed its normal position; a circumstance justly attributed by Yelloly to the fact, that the oculomotor had now also become deprived of its functions. A tumour of the size of a hazle-nut was found attached to the left side of the pons Varolii, extending to the left pyramid and entirely covering the left abducens. It had partially commenced suppurating, and was adherent to the basilar artery, whose coats were so rotten at this part that they yielded to the touch of the probe. A small coagulum lay upon the diseased point of the artery, as in aneurisms.

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[1] A delineation of the parts is given in Casper's Wochenschrift für die gesammte Heilkunde, 1824.

[2] Anatomie et Physiologie du Système Nerveux, vol. i, p. 448.

[3] Medico-Chirurg. Trans., vol. i, p. 183.

[4] Reports of Medical Cases, vol. ii, p. 49.

Tubercle, when deposited in the substance of the brain and at its base, and about the points of insertion of the nerves, gives rise to symptoms which it is often difficult to interpret during the patient's life. This was the case in the following observation, which Dr. Dittrich has published in the 'Prager Vierteljahrsschrift für Praktische Heilkunde.'[1] The patient, a man aged 27, had five years previously been affected with syphilitic gonorrhœa and buboes, which were cured in four months. Ten weeks previous to his admission into the clinical wards of Professor Oppolzer, on the 19th January, 1845, the disease had commenced with febricitation, a sense of oppression in the throat, and hoarseness. For five weeks there had been luscitas[2] of the left eye, accompanied by double vision and repeated headache at the temples and vertex, which was particularly violent at night. Four weeks previously he had a sensation as if his tongue were swollen; during the last fortnight dysphagia had supervened, so that he was unable to swallow solids at all, and fluids but slowly, and not without exciting cough; from this time he lost his voice, and during the last week he also complained of weakness, numbness, and formication in the left hand. When admitted he presented the following symptoms: there was slight emaciation, the skin was white, soft, and delicate, a sense of weakness prevailed throughout the body, the head was heavy, the left eye was affected with luscitas, so that the patient was unable to move it outwards. The power of vision was impaired in the photophobic eye; both pupils were of equal size, and reacted to the stimulus of the light. The left hand was weaker than the right, and was numbed and affected with formication. The sense of touch continued vivid, but the movements were less energetic than in health. The patient asserted that both his inferior extremities felt equally strong, but he dragged his left leg a little in walking. The left angle of the mouth was drawn down, the naso-labial line was indistinct, and when the patient laughed, only the right angle of the mouth was drawn up. The tongue was protruded quickly, but inclining obliquely towards the right side. There was complete aphonia. Both subclavicular regions were less resonant than in health, and there was an absence of the normal respiratory murmur. The appetite and taste were normal; a barking cough followed deglutition, which was effected with difficulty; the patient stated that the morsel stuck in his throat. The urine was alkaline. Death occurred five weeks after admission. The most characteristic symptoms during this period were the nocturnal headaches, tremors in both extremities of the left side, debility of the tongue and complete atrophy of its right half, and loss of vision of the left eye.

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[1] 1845, vol. iv, p. 97.

[2] [Luscitas is a term applied by Beer to that species of strabismus in which the eye cannot be restored to its normal position after the healthy eye is closed.]—Ed.

Sectio cadaveris.—The lower surface of the pons Varolii, as far as the origin of the vagus and glossopharyngeus, was firmly attached to the base of the cranium by a lardaceous, semi-transparent grey mass of tubercle. A similar mass, of the size of a pea, grey, coarse and tubercular, was sunk into the substance of the posterior left half of the pons Varolii, about three lines of the surrounding tissue were softened into a pulp; the remainder of the pons also appeared more flaccid and softer. The left abducens was entirely enveloped in the tubercular mass, the left vagus was firmly bound down to the jugular foramen and atrophied. The upper portion of the spinal accessory nerve, from the point at which it deflected from the medulla oblongata towards the foramen jugulare, was treble its ordinary size, nodulated and infiltrated with a grey, lardaceous mass. A tubercle of the size of a pea, of coarse, bacony texture, was imbedded in the superficial layer of the right corpus olivare, and compressed the root of the hypoglossus and facialis; the cerebral tissue adjoining, as well as in the immediate vicinity of the root, appeared softened and broken up. A yellowish grey crude tubercle of the size of a pea was imbedded in the anterior part of the right crus cerebri near the corresponding corpus albicans; the parts round the tubercle formed a soft pulp. The right half of the chiasma and the commencement of the right optic nerve itself, as well as the optic tract to the extent of about an inch, were infiltrated with a brawny tubercular mass, about two or three lines thick, so that no trace of the optic tract was perceptible. Its commencement was atrophied and semi-transparent. The substance of the cerebrum was somewhat softened; in each lateral ventricle there were about two drachms of serum; the right was rather narrower than the left one, owing to the greater distension and tension of the right optic thalamus and corpus striatum; both the latter felt softer than their fellows, and spongy. About as much of the medullary substance surrounding these parts and the pineal gland, as would equal a walnut in size, was softened; the sectional surface was pale, yellow, and brawny. The right half of the tongue was reduced to a tough, firm, membranous flap. In the apices of the lungs there were some cretified residues of tubercle contained in cysts. The solitary glands of the small and large intestines were tumefied.

If we now turn to the paralytic affections dependent upon the brain and medulla oblongata as central organs, we find that the prevailing physiological rule is conduction in a crucial direction corresponding to the anatomical law of decussation; which in man not only affects the medulla oblongata, laterally and from before backwards, but also prevails in other essential constituents of the brain, in the cerebellum, the pons, and the peduncles.[1]

The ordinary form of cerebral paralysis is unilateral, hemiplegia, involving the face, the tongue, and the extremities. The disease rarely assumes the form of paraplegia; when it occurs it takes this shape from the commencement, and is but rarely developed successively in both halves of the body, which is not unfrequently the case in spinal paralysis. The upper extremities are more frequently paralysed than the lower, and when the two are affected simultaneously the former suffers most. In the event of a favorable issue, the paralysis is more persistent in the arm than in the leg, while the reverse is the case in spinal paralysis. The paralysed muscles are either flaccid and faded, or contracted, and either temporarily or permanently so. Tremor frequently supervenes upon the paralysis.

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[1] See—Arnold; Bemerkungen über den Bau des Gehirns und Rückenmarkes, pp. 29, 42, 45; and Bell, on the Functions of the Brain, in the 3d edition of his work, pp. 218, 225.

In cerebral paralysis the power of inducing movement by the stimulus of mental impressions is entirely extinct, or it is imperfect (Paresis). In the latter case conduction is effected slowly and imperfectly; the determination and the execution are separated by an interval of several seconds and the pressure of the palsied head is powerless. On the other hand, the capability of being excited by other stimuli continues and is even exalted. Thus the extremities which are insusceptible of the stimulus of the will, may be roused by reflex irritation. If the volar surface is touched, especially with a hot or cold body, the hand and the entire arm executes a rapid movement, is drawn back, and starts up. It will sometimes happen that in other reflex movements, *e.g.*, those of respiration, as yawning or coughing, the affected limb makes sympathetic movements, while the healthy limb remains at rest.[1] Marshall Hall[2] has found that strychnine and galvanism operate more powerfully upon the paralysed than upon the healthy parts; it is even said that a current of galvanism so weak as not to be felt in the healthy limb excites contractions in the paralysed limb, which is not the case in peripheral and spinal paralysis; this is a subject which demands further investigation.

It is often difficult to determine the state of insensibility in cerebral paralysis, owing to the stupor or indolence that prevails; the anæsthesia of the cutaneous nerves does not generally attain to such a pitch as in spinal paralysis; it affects the upper extremity more than the lower, avoids the trunk, but not unfrequently attacks one half or individual portions of the face. The nerves of sense, especially the optic, are often implicated in the anæsthesia. The recovery of the patient is announced by the earlier return of sensation than of motion. In many cases a diminution of sensibility occurs as a precursor of paralysis; the patient often complains of numbness, going to sleep with formication, and a sense of chilliness, a long time before the attack. In cerebral more frequently than in spinal paralysis, the sensibility is unaffected; in other cases it is exalted, and pain manifests itself in the paralysed parts, especially when the muscles are contracted.

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[1] See Parry's Collections, &c., vol. i, pp. 488—500.

[2] Marshall Hall; Uber den Zustand der Irritabilitat der Muskeln gelähmter Glieder, in—Müller's Archiv, 1839, p. 215.

The function of nutrition suffers to a greater or less extent, and more or less rapidly in the paralysed parts in cerebral paralysis, in proportion to the degree and duration of the muscular inactivity. The atrophy of the thin and soft parts is greatest in congenital paralysis; paralysed limbs whose muscles are contracted become more rapidly emaciated than where the muscles are flaccid. I have not seen atrophy extend to the tongue in cerebral paralysis, although it occurs in peripheral affections. In hemiplegia of long standing I have found the nutrition of the horny tissues abnormal; the epidermis becomes dry, rough, laminated; the nails, especially those of the fingers, are elevated, ragged, and brittle. In a few tedious cases I have met with œdema of the paralysed limbs. We do not as yet possess a sufficient number of observations to determine the changes of temperature that take place. Several of my patients complained of a sense of cold, some of a burning heat, without any physical diminution or increase of the temperature. The debility, irregularity, and even arrest of the pulse in the paralysed arm, observed by some older authors, has not hitherto occurred to me as a result of cerebral paralysis; in many cases it is probable that obliteration, rigidity, and ossification of the arteries have been overlooked in aged paralytic individuals.

In addition to the peculiarities hitherto described, there is one criterion of cerebral paralysis, which is based upon the physiological endowment of the brain as a central organ, viz., the power of communicating its conditions. The intellect in its totality or in some of its manifestations becomes impaired, and this state is accurately reflected in the corporeal symbols of the mind, speech, physiognomy, and the play of the features. Not only does the articulation become slow and hesitating, but the individual more or less loses the faculty of conveying his impressions in the definite form of language. The features become expressionless and flaccid. Absence of mind, forgetfulness, unconnected thought, want of resolution and determination, indolence and effeminate weeping upon the slightest inducement, are the symptoms marking consecutive dementia with broader or narrower outlines; on the other hand, a soporous condition, varying in degree, accompanies the paralysis from its commencement, or supervenes sooner or later.

These general features of cerebral paralysis are undoubtedly modified according to the seat of the disease; but although we possess a large number of post-mortem examinations, it is a matter of extreme difficulty to give even an indication as to the effect of certain topical lesions. Our very imperfect knowledge of the brain is chiefly at fault, yet medical men are not the less to blame for the anatomical inaccuracy of their observations; in no cases is it more necessary that the post-mortem examination should be made by a practised hand than in this department. The fact that is most positively established, and is scarcely threatened by a single exception, is the law of crucial conduction. We still find some old observations to the contrary quoted, even by men like Valsalva and Morgagni; but in these cases it is evident that at a time when the process of absorption of coagula and softened portions was unknown, the paralysis left by a former apoplectic seizure was ascribed to the last and most recent disease. A further error arises from a false interpretation of those cases in which an existing affection of individual portions of the brain arrests the conducting power in the peripheral portions of the nerves passing off at the diseased part. Nor can it be denied that in a well marked case of hemiplegia, too little attention is directed to the opposite side, and that a less degree of diminished motility is often overlooked.

When the disease at the same time affects opposite hemispheres of the cerebrum and cerebellum, the paralysis accords with the former. Disorganisation involving exclusively the grey matter rarely induces hemiplegia. The residues of peripheral hæmorrhage in the convolutions of the brain, which occurs frequently in advanced age, and was first described by Cruveilhier, as well as the softening of the cortical matter in the so-called paralysis of insanity, are much more frequently accompanied by idiocy and diminished control of the movements by the will, than by a real loss of the motor power. In attempting to determine the paralysing influence of individual portions of the brain, authors have generally acted with a want of due criticism, and have drawn hasty conclusions from imperfect post-mortem examinations. The results are the less to be relied upon as the disorganisation which induces the paralysis is very often associated with other morbid conditions of the brain. The turgescence of the cerebrum which is enclosed in an unyielding bony case, to which I have already drawn attention, plays the more important part in the present case as its influence extends to the healthy hemisphere also. Andral[1] relates a case in which the left hemisphere, which was the seat of extensive softening, was so much swollen, that the mesian fissure no longer occupied the middle line, but was pushed over to the right. In one patient, a female, Cruveilhier[2] found the cerebral convolutions softened and dark red, and so much tumefied that they necessarily exerted a considerable pressure. In the progress of organic diseases of the brain, accompanied by paralysis, the supervention of serous accumulation in the cavities and on the surface gives rise to a compression, so that the limits of the paralytic symptoms do not continue as clearly defined as at the commencement. Hitherto these limits have not been indicated with that accuracy which is necessary; observers were content with mentioning that an entire limb was paralysed, without having any regard to the individual groups of muscles. Tanquerel's method of examining limbs affected with lead palsy, may in future serve as a model for these investigations.

The course of the medullary fibres from the spinal cord to the corona radiata and the hemisphere has hitherto only been shown in the roughest outlines, as followed with the naked eye in recent or hardened brains. The demonstration of different elements, and of their motor or sensory attributes, yet lacks much to render it at all satisfactory. We may expect some advancement in our knowledge of this subject by the dissection of the brains of subjects who have been paralysed for many years, and in whom the function of motion alone was impaired. An opportunity of this kind presented itself to me in the person of a girl, aged 19, who, according to her father's statement, had been born healthy, but was attacked with violent convulsions at the age of 3 months, followed by paralysis of the right extremities. She was small for her age, and imperfectly developed; the arm and leg of the right side were much emaciated and were only half the size of their fellows. The fingers of the right hand felt as if they consisted only of soft tissues; at the same time they were generally contracted and turned in to the hollow of the hand, but could be easily extended. The movements of the foot and arm were very much limited; the foot was dragged in walking, and the patient was unable to squeeze with her right hand, or to raise the arm at all. At the same time there was no trace of paralysis in the face or the tongue. The patient's speech, though monosyllabic, was unimpeded. The sensibility of the limbs was normal as well as the functions of the senses; but the intellect was almost reduced to a par with idiocy. The girl could only find expressions indicative of hunger and pain; she was unable to fix her attention or to form any idea. Menstruation occurred at the age of sixteen. In my lectures I stated my diagnosis to be atrophy of the left hemisphere of the cerebrum, and that as there was no external depression of the cranium, I assumed the vacant space to be filled up by serum. Death ensued from phthisis pulmonalis, and the post-mortem examination was made by Professor Henle on the 4th of March, 1838. In removing the calvarium the saw accidentally penetrated too deep, and caused a quantity of sero-sanguineous fluid to escape. The left half of the cranium was half an inch narrower than the right, and the left os frontis was thickened. The middle of the upper part of the left cerebral hemisphere was absent, and in its place was a serous cyst, which had been torn in opening the cranium, and had discharged its contents. This cyst was only separated from the lateral ventricle by its investing membrane. On dividing the latter, the ventricle was found dilated and containing a large quantity of clear serum. The foramen Monroi was much distended; the walls of the ventricle were half wanting, nothing but rudiments of the thalamus opticus and corpus striatum remaining, and they were bounded by a margin of the hardness of cartilage. No morbid appearances presented themselves in the corpus callosum, the fornix, the septum lucidum, and the anterior commissure. At the base of the brain, the optic tract, the eminentia mammillaris, the crus cerebri, the pons, and the pyramid of the left side were atrophied; the latter was converted into a thin strip, only a quarter the size of the right pyramid; at the same time the restiform bodies of both sides presented a normal volume, and the olivary body of the left side was even more arched and much fuller than that of the right. The dimensions of both hemispheres of the cerebellum were the same;[1] the brachial plexus of the right side was normal. We were not permitted to open the spinal canal. In this case the commissural structures were sound; but a tract that extended through various cerebral structures was atrophic owing to its not having been able to execute its functions. A few similar cases are recorded in Cruveilhier's 'Pathologie Anatomique' (Liv. viii), and in Carswell's 'Pathological Anatomy,' under the heading of Atrophy. (Plate iv, fig. 2.)

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[1] Clinique Médicale, vol. v, p. 464.

[2] Cruveilhier; Anat. Patholog., livr. xxxv, p. 6.

The attempt has often been made to discover detached foci of innervation in the brain, but it has invariably failed. Experiments upon living animals, which are effected only with great destruction of tissue, and surgical injuries accompanied by concussion, are of as little use in determining this point as complicated diseases of the brain. It is necessary to obtain a secure foundation, in order that the subject may not suffer under the stigma applied to phrenological mapping out of the brain. The examination of the brain of amaurotic individuals (see vol. I, p. 240) may serve to indicate the method to be pursued; we must seek to operate upon the centre from the surface. The following observation has been recorded by Lallemand[2] for a different purpose, but it is important in reference to the subject under consideration: A soldier, aged 38, had received a thrust with a lance in his right shoulder, in consequence of which a large aneurism of the axillary artery had formed. As a rupture threatened, a ligature was applied to the subclavia. As the ligature was tightened, the patient experienced a vivid pain in his neck. This diminished on the following day; warmth and sensation were restored in the arm. The pain returned on the fourth and fifth day; it became more violent on the seventh, and no relief was afforded by four bleedings. In the night preceding the eighth day the patient became deprived of consciousness, moved the legs restlessly (the arms being bandaged up), the pupils were immoveable, respiration became short and quick, and the pulse small and irregular. On the eighth day the head was bent backwards, and death ensued in the evening. The autopsy showed that the ligature had encircled those branches of the brachial plexus which pass off from the third cervical pair. The posterior lobe of the left hemisphere of the cerebrum presented a greenish hue at its surface; it was excessively softened within, and also of a greenish colour. In the middle there was an abscess extending to the lateral ventricle, from which above a tablespoonful of greenish pus was discharged. The cerebral tissue, to the extent of about two or three lines round the abscess, was injected and of increased consistency. This case appears to indicate that continued irritation of single peripheral nerves operates in a crucial direction upon a definite part of the brain, and there induces disorganisation. It served as an inducement to me to institute experiments upon living animals to establish if possible, as it were, a nervous injection from the circumference to the centre. On the 24th May, 1834, assisted by Dr. Henle, I tied the median nerve in the left axilla of a sheep affected with the staggers, and applied liquor potassæ to about half an inch of the nerve above the ligature, and it at once became brown. The animal gave a jerk, and by groaning and grunting showed that it felt the pain acutely; its respiration was very quick and irregular. The left fore leg was paralysed. On the 25th May its breathing was calmer; when stirred up with a stick, the animal rose up and stood upon three legs, the left foreleg dangling uselessly by its side. On the 26th of May paraplegia supervened, in walking and standing the weight of the body rested upon the left fore leg. Respiration was much accelerated and irregular, and death ensued at midday, forty-four hours after the experiment had been performed. The median nerve, which in part arose from the sixth and seventh cervical nerves, had lost its normal appearance and structure above the ligature; it was flattened so as to resemble a ribbon; was of a greyish red dirty colour, and softened. The dura mater of the spinal cord from the second dorsal nerve to the occipital foramen was uniformly red at its lower surface; on the upper surface this redness only showed itself in the interspace between the sixth and seventh cervical nerve. The texture and consistency of the spinal cord were normal, except that it was somewhat atrophied below the eighth cervical nerve, but this could not be set down to the experiment. The surfaces of both hemispheres of the cerebrum were covered with extravasated blood, especially along the course of the large vessels. The cerebral tissue itself of the right hemisphere appeared normal throughout. The left hemisphere was almost completely excavated and filled with the cyst of the cœnurus; the cerebral matter surrounding it was yellow and cribriform. The cranial bones presented a normal consistency, but on the left side, where the bone covered the hydatid, it was rather thicker than elsewhere.

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[1] The brain is preserved in the Anatomical Museum of Berlin; it has been accurately delineated in the Inaugural Dissertation of Dr. Edward Henoch, De Atrophia Cerebri; Berol., 1842.

[2] Recherches Anatomico-Pathologiques sur l'Encéphale, &c., vol. i, p. 123.

A few more experiments were instituted upon nerves that are nearer the brain. On the 17th of July, 1839, Professor Gurlt had the kindness to lay open the infra-orbital nerve in a glandered but otherwise healthy horse. When this large branch was irritated, it produced great pain, and the animal kicked about, but there was no trace of reflex tension in any of the facial muscles. Extending the nerve by passing the bistoury under it caused no pain whatever. As it was supposed that the neurilemma might act as an isolating medium, and thus prevent the success of the experiment, it was repeatedly touched with acetic acid at the point of its exit from the bone, which caused it to assume a yellowish-brown colour. A brass wire was then put loosely round, and its point pushed into the nerve. The left half of the nose and upper lip were deprived of sensation. On the two following days the part was again touched with acetic acid. A brownish-red ichorous fluid ran out of the wound. The sensibility of the nerve was much augmented above the loose loop; so that the most trifling touch caused the animal to start, and turn away its head. The reaction was much less lower down. The horse was kept alive for a fortnight. No difference was perceived in eating between the right and left half of the upper lip, as Bell thought he had observed. In order to produce a more vigorous effect upon the nerve fibres, a solution of potash was applied several times. The animal was rapidly killed on the 1st of August, by blowing air into its veins. Professor Gurlt dissected out the nerve in the face, and in its passage through the cranium. The part that had been irritated was alone the seat of an albuminous exudation between the nervous fibres, by which it had become as hard as cartilage. Beyond this point the structure was normal, as well as throughout the second branch of the fifth. No morbid change could be discovered in the cerebrum or cerebellum, in the pons, or in the medulla oblongata. We have already communicated an experiment upon the supraorbital nerve of a horse, in which the result was similar. As a counterpart to this negative effect, I may mention the result of an experiment which I performed in 1833. I tied two of the branches of the supraorbital nerve on the right side, and four on the left side in a goat, in whom this nerve does not issue from the frontal bone in one trunk, but by several branches through as many apertures. In this case no influence was exerted upon vision, but after the lapse of a fortnight the symptoms of a cerebral affection supervened, and the autopsy showed softening of the lateral walls of the lateral ventricles, which contained a moderate quantity of serous fluid. There can be no doubt that by repeating experiments of this kind upon quadrupeds, we may obtain some instructive results, provided the animals are kept alive for a sufficient length of time.

We can only regard those pathological observations that are intended to cast a light upon the distribution of the fibres in the central organs, and assist in diagnosing the seat of the disease, with confidence, which are characterised by the precise limitation of the paralysis and the disorganisation, by the long and unaltered persistence of the symptoms, by the absence of complication, and by the uniformity of the different cases. Most attention has been paid to the isolated paralysis of individual limbs, and of the tongue. There is only one conclusion at which we have arrived, which seems to be a rule, with scarcely any exception, viz. that when paralysis of a leg or an arm is the result of a cerebral affection, its seat is in the cerebrum. The relation assumed by some modern writers (Foville, Serres) to exist between the thalamus opticus and the upper extremities, and between the corpus striatum and the lower, has not been confirmed ; it seemed doubtful from the first, as a large portion of the fibres that come from the crus cerebri pass through the thalamus to the corpus striatum. It would be interesting to determine whether the different direction taken by the fibres radiated from the corona radiata exerts a greater influence. The fibres which emanate from its posterior margin enter the posterior lobe of the cerebrum, and it was here that in Lallemand's case the reaction produced by the application of the ligature to several nerves of the brachial plexus, was manifested. A case communicated by Rostan[1] also meets the conditions which we have laid down for such observations. An old woman, above 60 years of age, was affected with a paralysis of the right arm exclusively; it had occurred when she was 16 months old, in consequence of a fit of convulsions, and the limb was atrophied and shortened. Sensation was undisturbed; death ensued from a thoracic affection, and on examination only a rudiment of the posterior lobe of the left hemisphere was found remaining; it was entirely deficient above and externally, so that to the extent of about two inches the wall of the ventricle was visible under the arachnoid; the ventricular epithelium at this part was covered with a transparent false membrane; round about this extensive loss of substance the convolutions were small, corrugated, and atrophic. The ventricle contained a considerable quantity of serous fluid. The cerebellum and spinal cord were normal. The nerves of the paralysed arm were thicker than those of the healthy limb, and of a dark yellow colour. Andral, who is generally so accurate and trustworthy, gives a statistical resumé of the relations of the seat of the disorganisation to the seat of the paralysis; and it appears that among twenty-three cases of isolated paralysis of the arm, there were eleven presenting morbid changes in the corpus striatum and anterior lobe. But such a statement can avail little, when we are not even informed of the circumstances under which the paralysis occurred; nor is it unimportant that the names of the observers are withheld. Rostan[2] expressly states, as a well known fact that observations of this kind have been manufactured ad libitum; and he adds, with French politeness: "peut-être auraient-elles été communiquées à M. Serres, qui leur aura ajouté cette confiance qu'on ne rencontre que chez les personnes elles-mêmes très véridiques."

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[1] Recherches sur le Ramollissement du Cerveau, 2d ed., p. 256.

[2] Loc. cit., p. 251.

The exclusive paralysis of a leg, as a consequence of cerebral disease, is a rare occurrence. In Andral's table twelve cases are quoted, in ten of which the disorganisation was seated in the corpus striatum or in the anterior lobe; in two, in the thalamus opticus or posterior lobe. I have only met with one case of this kind, and that was not quite free from complication; it occurred in an old woman of 73, who applied to me for advice in 1828, for paralysis of the right arm and leg. The muscles at first were flaccid; subsequently they contracted so forcibly, especially at the hand and forearm, that the fingers could only be opened by using considerable violence; but they did not remain extended, but instantly returned to their former position, like elastic springs. Owing to the long continuance of the disease, depressions had formed in the palm of the hand, which were covered with a mucous membrane, and secreted a thick fluid of an offensive odour. The contraction of the foot was less forcible. Death ensued four years and a half after the supervention of the hemiplegia, which had become associated with dementia; and six months before the fatal issue, paralysis of the left leg occurred, with contraction of the muscles. The left arm retained its motility undisturbed to the last. The post-mortem examination was made on the 15th of February, 1832. In the upper lobe of the left hemisphere of the cerebrum, close to the corpus callosum, there was a brown spot of indurated medullary substance, which extended through the left half of the corpus callosum into the left half of the septum lucidum, and passed gradually into the healthy tissue. The left thalamus was flattened and atrophied, and half an inch smaller than the right one. An old apoplectic cyst, of the size of a cherry, was found near the surface of the posterior lobe of the left hemisphere; it was surrounded by indurated cerebral tissue, lined with a thin membrane, and contained some ochrey blood. There was a hardened spot of the size of a hazlenut, knotty, and of a brown colour, occupying the right corpus striatum and the adjoining medullary tissue; it looked as if a considerable time previously blood had been exuded into it, which had been partly absorbed, and had partly dried up and become interwoven with the cerebral tissue itself; I have repeatedly met with such a residue of former hemorrhages without any trace of a cyst. The trunks and smaller branches of the cerebral arteries were much incrusted so far as I followed them. The dura mater was firmly adherent to the cranium at numerous points. The arachnoid was thickened, covered with exudations along the falx, and adherent to the pia mater.

We possess various hypotheses relative to the determination of the central lesions affecting the nerves of the tongue; and much as they differ from one another they are supported by observations; in the majority of cases the observer has failed to distinguish the part which the brain plays in glossoplegia, as the organ of the mind, from the influence which it exerts as the source from which the fibres of the hypoglossus draw their origin. I select the following five instances, because they are as uncomplicated as possible, though I ascribe no further value to them than that of exciting attention. The first occurred in an aged female, who three years previously had suddenly lost her voice, without any disturbance of consciousness, motility, or sensibility. The movements of the tongue were entirely unfettered. Death was brought on by a disease of the heart. At the post-mortem, Andral[1] found a spot of softening of the size of a large pea near the posterior end of the left corpus striatum, and a similar spot in the right hemisphere at the union of the anterior and posterior halves, equidistant from both sides. Bright[2] has described two cases which so entirely correspond in the identity of their symptoms and their autopsies, that they may be compared to accurate physiological experiments. In both there was impeded articulation throughout the disease for several months; there was difficulty of deglutition, and repeated attacks of incomplete paralysis of the extremities had occurred; but the mental powers were unembarrassed. No morbid change was found in the brains, beyond softening in the two corpora striata, with some remains of sanguineous extravasation. The fourth and fifth cases occurred in the range of my own observation. A schoolmaster, aged 60, had been subject to paralysis of the inferior extremities for a year and a half, the sensibility not being at all affected. From the commencement he had suffered from impeded articulation; some time elapsed before he could pronounce a word, and then it was uttered with a sudden explosion, accompanied by a hissing sound. The stammering increased subsequently more and more, and at last became an unintelligible jumble of sounds, while the mental powers continued unimpaired. The locomotion of the tongue remained normal.

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[1] Clinique Médicale, vol. v, p. 454.

[2] Reports of Medical Cases, vol. ii, pp. 296—301.

Professor Schlemm had the kindness to examine the brain. The only lesion found was a peculiar species of atrophy affecting the left corpus striatum, the preparation of which is still in my keeping. The medulla oblongata was healthy. We were not permitted to open the spinal column. The fifth case occurred in a watchmaker, aged 39, who having long been suffering from pulmonary tubercle, was brought home on the 24th Nov. 1824, speechless and motionless; having suddenly fallen down in this state, after exposing himself to a draught while covered with perspiration. I saw him soon after: the extremities of the right side were paralysed and deprived of sensation; the right eye was blinded, its pupil dilated, and though consciousness was unimpaired, the faculty of speech was entirely abolished. Under antiphlogistic treatment, the anæsthesia and the amaurosis disappeared during the following days, but the hemiplegia and speechlessness continued until death. Violent pains had also supervened in the right leg, and continued almost without intermission. The pulmonary disease made rapid progress, and the patient died on the 14th of February, 1825. At the autopsy the brain was found to be normal, with the exception of the left corpus striatum, which was purilaginous and of a brownish colour, interspersed with red spots. There were numerous tubercles and several excavations in both lungs, and the left ventricle of the heart was hypertrophied.

When single nervous tracts are paralysed, we very rarely have an opportunity of demonstrating a circumscribed lesion in the brain. For this reason, as well as on account of the character of the individual affected, the following case is not without interest. In the year 1834, while delivering a clinical lecture, Dupuytren was attacked with paralysis of the left facial nerve, and he had the courage to continue his discourse while he supported the left angle of the mouth with his finger. He had already on a previous occasion had a slight attack of vertigo, which subsequently returned during a journey in Italy. The left ala nasi continued collapsed until his death in 1835. His friend Cruveilhier, who examined the head after death, found a light yellow cicatrix on the inner surface of the right lateral ventricle behind the thalamus opticus, at the entrance to the posterior horn. A small cavity filled with brownish cellular tissue was found in the right corpus striatum, and another one of the same kind in the grey centre of the left corpus striatum.[1] This case also serves to confirm the fact, that a lesion confined to the grey substance is not followed by a loss of motility, as, with the exception of the one-sided facial paralysis, which is accounted for by the cicatrix in the opposite lateral ventricle, Dupuytren never suffered from any other paralytic affection.

We have already mentioned, that the paraplegic form of cerebral paralysis is one of extreme rarity. It would be of still less frequent occurrence, if the observers had been more chary in assuming paralysis, and had not included immobility from want of resolution, or irregular or imperfect movements owing to static disturbances, under the head of paralysis; on the other hand, cases in which conduction has really been destroyed in both halves of the trunk, are inadmissible, if the examination of the spine has been neglected. Disorganising processes and morbid growths in the medulla oblongata, in the adjoining cerebellum and pons, are often accompanied by more or less complete paraplegia, and this is also sometimes the case in coexistent or successive changes in the hemispheres of the cerebrum or cerebellum. It shows itself most frequently in chronic hydrocephalus, where it especially affects the lower extremities. Gölis[2] states, that when the child is put down on its feet and left unsupported, it instantly sinks down; when held on both sides it tries to move forwards, but the semi-paralysed foot drags heavily over the other, so that the calf of the former lies upon the tibia of the latter, and cannot be brought further forward.

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[1] Cruveilhier: Anatomie Pathologique, livr. xx, p. 11.

[2] Gölis; Praktische Abhandlungen über die Vorzüglicheren Krankheiten des Kindlichen Alters; Wien, 1818, vol. ii, p. 43.

We are better acquainted with the varieties of paralysis which depend upon the peculiar character of the cerebral affection, than with the influence of the seat of the disease. The progress of the paralysis, and the condition of the paralysed members, differ according as the affection is caused by a rupture of the central motor fibres, by irritation, pressure, atrophy, or a complication of these conditions. Cases without complication, and chronic, in which the paralysis is the prominent and isolated feature, are the most instructive. The termination of the disease is not suited for such observations, as the specific features of paralysis are obliterated by the entire prostration of the cerebral powers.

Paralysis resulting from rupture of the cerebral fibre, is produced by hæmorrhage into the brain. It is not developed, nor does it increase, gradually, but is at its height from the commencement, and has a persistent character. The muscles are generally flaccid. Some French physicians[1] assert, that when the hemorrhage makes its way into the ventricles, or to the surface of the brain, the paralysed muscles contract, but I have not convinced myself of the truth of this fact in two cases which I have observed accurately. Sensation rarely suffers; and when anæsthesia does occur, it is not persistent.

Inflammation affecting the cerebral substance induces disorganization with irritation, which is clearly manifested in the paralysis that results, by the following characters: 1. Spasmodic supervene upon the paralytic symptoms; the most common are stiffness and contraction of the limbs; they may be permanent or evanescent, and affect individual groups of muscles or be extended to many. 2. The symptoms have a variable character, amelioration alternates with a stationary condition or relapse. At times the fingers recover their motility, the patient is able to exert a more powerful pressure with his hand, can raise his arm better and move his leg with greater ease, but sooner or later not only a return, but even an increase of the paralysis occurs, which is laid to the account of matters of little consequence while it is the natural course of the disease. 3. Participation of sensibility, diminution and loss of cutaneous sensation, pain which associates itself with anæsthesia, or occurs by itself, especially in contractions, and becomes very severe when attempts are made to extend the limb. These characters also appertain to the paralysis resulting from the consequences of inflammation, softening and induration. A few examples, taken from my casebooks, may serve as illustrations.

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[1] Durand Fardel, Traité du Ramollissement du Cerveau; Paris, 1843, p. 195.

A man, aged 66, was seized in September 1835, with an apoplectic attack, in which the right side, and especially the arm, became paralysed; he recovered from this in a few weeks, excepting a slight residuary weakness of the upper extremity. The seizure was repeated in the beginning of November. The right eye was patent; the eyelid hung loosely over the left one, the left angle of the mouth was drawn down; the patient was unable to put out his tongue and to utter an articulate sound; the arm and foot of the right side were paralysed, and the muscles of the right arm contracted, so that the hand was bent upon the forearm and the latter upon the upper arm. Every attempt to extend the limb was followed by much pain; the patient often screamed out loudly from the pain in the paralysed limbs. Sopor and sloughing supervened, and on the 5th of December the patient died. At the post-mortem the left corpus striatum was found to present a brownish-yellow softening; its striated texture was entirely destroyed, and the anterior and a portion of the middle lobes of the left cerebral hemisphere were softened. A considerable quantity of sero-albuminous fluid was accumulated between the arachnoid and the pia mater of the cerebrum.

An old woman of 80 years of age, was affected with paralysis of the right arm and leg, following an apoplectic seizure which had occurred two years previously. The sensibility of the limbs as well as the reflex action was undisturbed. When the skin of the forearm was pinched the arm drew back, but the patient was unable to perform the movement with the strongest effort of the will. Whenever she took a deep inspiration, a rotatory movement of the paralysed upper arm took place, which was continued to the forearm. During the last half year the hemiplegia decreased, but the intellectual power was diminished. On the 11th May, 1834, the apoplectic seizure was repeated, causing complete paralysis of the right arm and leg. A new symptom was also manifested. The head was bent down to the shoulder in such a manner that I was unable to raise it from this position with any force that I could employ. Articulation and deglutition had ceased. The patient had the greatest difficulty in protruding her tongue, and she uttered a few unintelligible sounds; all the food taken either returned from the mouth or fell in crumbs or drops into the larynx and induced suffocative attacks. Death ensued on the 14th May. The contraction of the muscles continued eight hours after death. Sectio cadaveris: in the posterior and middle lobe of the left cerebral hemisphere in the vicinity of the thalamus opticus, a peculiar disorganisation presented itself such as I have met with several times. The colour was yellowish, the tissue of a soft consistency; the cut portion could be drawn out like honey; the substance was porous and traversed by little cavities that looked like what are called the eyes in Gruyère cheese. The left crus cerebri was thoroughly softened, and of a brownish black colour. The upper and inferior portion of the left hemisphere of the cerebellum were converted into a very soft mass soaked with blood. This disorganisation passed imperceptibly into the healthy tissue, which was traversed by numerous gorged vessels. The anterior lobe of the right hemisphere of the cerebrum was the seat of red softening of a purple, spotted appearance. The larger and smaller vessels of the brain were for the most part encrusted. No serum was to be found either in the ventricles or on the surface. This case is distinguished by the contraction of the muscles of the neck on the paralysed side, by which the head was drawn down rigidly and retained in that position. The same phenomenon was perceived in the patient described at page 420, where there was softening of the cerebral substance of the posterior lobe and in the thalamus opticus. A similar inclination of the head to the opposite side has been observed to occur in living animals, after division of the crus cerebri or the thalamus opticus.

A woman, aged 49, previously in good health, complained of vertigo, tinnitus aurium and weakness of the left arm at the time her menstruation began to be irregular. In February 1842, twitchings occurred in this extremity, and the weakness increased to paralysis. She was only able to raise her left arm with the assistance of the right hand. The fingers were permanently contracted and cutaneous sensibility was diminished, especially on the exterior surface. The movements of the right arm were also effected with some difficulty, and both inferior extremities refused to do their duty when she rose up; with the support of another person she managed to drag herself a few steps, and the feet in doing so were crossed as they are in hydrocephalic children. The treatment consisted in venesection, repeated cupping in the neck and derivation to the intestinal canal. Towards the end of the month the left arm showed a marked improvement in regard to motility and sensibility, and the patient was again able to raise it. The contraction of the fingers had ceased. On the 10th March, there was mental excitement; the muscles of the face twitched spasmodically, and the patient moved her arms restlessly. After a venesection had been made at the foot, the menses recurred copiously, but without exerting any beneficial influence. From this time a marked diminution in the intellectual powers manifested itself; the patient had a difficulty in collecting her thoughts, her speech was hesitating, she complained frequently of pains in the head and limbs, which were so intense at times, that she uttered loud screams. She began to talk wildly and confusedly, sometimes she knew those who surrounded her, at others, she did not recognise them. Repeated doses of morphia lulled her. The curious phenomenon which I have termed the echo, now manifested itself, and continued until shortly before death; the patient repeated the words spoken near her, without attaching any meaning to them. She would constantly repeat my questions addressed to her, "put out your tongue—raise your arm," without doing as she was bid. The delirium continued during the month of April, with intervals of quiet days, on which consciousness was less obscured. The paralysis and contraction advanced rapidly and were particularly marked in the left arm and right leg. When sitting up in bed the patient, even if supported, had a constant tendency to fall forwards. In the month of May, amaurosis of both eyes, with immobility of both pupils, which were moderately dilated, supervened. The psychical state alternated between lucidity and loud delirious talking. The paraplegia was complete, the contractions which had been confined to the fingers ceased during the last five days, and the fingers and arms could be extended without causing any pain. Calmness, memory, and consciousness returned. On the 25th May, death ensued with symptoms of pulmonary paralysis. Both hemispheres of the cerebrum and cerebellum, both thalami optici and corpora striata, were found to be the seat of numerous spots of inflammation; there were about twenty in various stages of development, some presenting simple congestion and increase of consistency, others a dark red hue with incipient softening, others again a dark white colour and pultaceous consistency. Some had even commenced to form abscesses and were inclosed in a false membrane. In one of the spots in the middle of the right cerebral hemisphere there was an extravasation of blood which had separated into a thin serous fluid and a grumous coagulum. The size of the spots varied from that of a pea to that of a sixpence; the majority were round, some of an oval shape. The smaller ones were most numerous in the corpora striata.

A woman, aged 28, formerly enjoying good health, presented a change in her mental constitution, which had resulted from an injury received several years previously by striking her head against an iron rod. She lost her joyousness; she became indolent, ill tempered and suspicious of her husband. She often was insuperably sleepy by day, so that she would go to sleep while sitting up in her chair. A violent oppressive headache returned in indefinite periods, continuing for days and weeks; it diminished in cold and became insupportable in hot weather. In the commencement of December, in 1838, while cutting bread, the left hand of the patient was suddenly paralysed, and became tremulous; but the symptom excited little attention, as it soon disappeared again. On the 21st December a more serious attack occurred. The patient had gone to sleep while sitting in a chair, and with her head leaning against the stove. On waking up she was unable to move either arm or foot of the left side; her speech was slow and laboured, though the tongue when protruded continued straight. The left upper eyelid was sunk lower than the right, and the mouth was drawn somewhat to the right side. The head was hot and the face flushed. A venesection, cold lotions and purgatives were ordered. The paralytic symptoms diminished from day to day. Motility was restored first in the foot and then in the hand; in the latter it returned first in the little finger and gradually extended from finger to finger, till it reached the thumb. Her speech also became more fluent. On the tenth day after this attack a relapse threatened, walking was rendered more laborious, the left eyelid sunk, and the pulse became frequent. A venesection restored the patient to comparative health. A second violent attack occurred on the 19th February, 1839. The patient was found lying on her bed with her right side paralysed; the right eye was amaurotic, and the tongue immoveable. Consciousness became daily more obtuse; every question was answered by a monotonous "yes," and at last no response at all was given. In the limbs of both sides of the body immobility alternated with tremors and spasms, which during the last weeks of life became particularly violent at night, and also attacked the pectoral muscles. On the 11th March, the facial muscles were also attacked, the patient beginning to laugh violently upon the application of any stimulus, whether spoken to or whether she moved a limb. The fatal issue occurred on the 18th of May, preceded by coma. At the post-mortem, which was made on the following day, the central portion of the right cerebral hemisphere was found completely softened, and of a greyish-yellow colour. A similar but more extensive disorganisation was found in the left hemisphere, where it reached to the base and involved the thalamus opticus.

Doubts and objections have been raised to the doctrine that the symptoms of irritation may be associated with paralysis, depending upon softening of the brain, but this is owing to the different states of softening having been confounded by the nosologist as well as the pathological anatomist. I shall have occasion to revert to this subject more fully when treating of the formative diseases (Bildungskrankheiten) of the nervous systems; it may suffice to mention at present, that in one species of softening there is an exudation of coagulable matters, and the microscopic analysis conducted by Valentin, Gluge, and especially Bennet, has demonstrated the presence of exudation corpuscles, aggregations of granules, &c. In a not inconsiderable number of cases, minutely described, Bennet has invariably found symptoms of irritation, and more particularly contraction, associated with paralysis.[1] This inflammatory softening is very often associated with other disorganising processes of the brain, such as hemorrhagic cysts, tumours, &c.; and is either the immediate cause of encephalic paralysis, or when paralysis had previously occurred, it gives rise to one or more of the symptoms already alluded to.

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[1] Bennet; Pathological and Histological Researches on Inflammation of the Nervous Centres; Edinburgh, 1843, p. 78.

Paralysis, arising from compression of the brain, is generally characterised by gradual development, and by a combination with local or general convulsions. The peculiarity of the compressing tumour, its seat and extent, as well as the condition of the surrounding cerebral tissue, exert an undeniable influence upon the symptoms. Carcinomatous tumours are often characterised by violent pains in the paralysed limbs, which often precede the paralysis, and are accompanied by intense cephalalgia. The wife of an artist, aged 45, who was under my care, had for eight years suffered from intense, tearing pains in the right side of the head, as well as in the left arm and leg, in which the power of movement had for some time become impaired. In November and December the hemiplegia increased, the patient was only able to elevate the arm to a certain height, and dragged the foot. The reflex movements excited by pinching and titillating the skin were effected with greater rapidity. She continued to complain of pains in the paralysed limbs, to which evanescent contractions, especially of the left knee, supervened. The cephalalgia had ceased from the time at which the paralysis occurred. Consciousness continued unobscured, but her speech was hesitating and laboured. At last the motility of the left leg and arm were entirely destroyed; the pains and contractions ceased, and death ensued on the 15th of February, preceded by hæmoptysis. On opening the cranium I found the dura mater firmly adhering to the bone at several points, especially in the vicinity of the posterior lobe of the right cerebral hemisphere. At this part the inner surface of the bone was rough, and looked wormeaten. The meninges at this point were firmly adherent to one another and to the brain. The latter exhibited a carcinomatous bluish-white mass of the size of half an egg; through this some hard nodes were scattered, of which a few portions adhered to the dura mater, when it was removed, like plugs. Round this disorganised mass a softening of the brain commenced, which occupied the greater part of the posterior and middle lobe; it extended to the level of the ventricle and the adjoining layers of the thalamus opticus, and in part also of the corpus striatum, all of which were converted into a creamy substance, which was easily taken up by the handle of the scalpel.

Tubercular tumours, which are most liable to occur in infancy, are commonly accompanied by convulsions, which either precede or coexist with the paralytic affection; and according to my own experience, more particularly when the cerebrum is the seat of the deposit. The most remarkable instance that has occurred to me, happened in a boy of 7 years, who was brought to me in 1836; from his infancy he had suffered from paralysis of the right arm and foot, the sensibility of the parts continuing unimpaired; he was subject to epileptic paroxysms, during which the paralytic and emaciated limbs were also seized with spasmodic twitchings, and he was likewise idiotic and deprived of the power of speech. An attack of meningitis proved fatal. An extensive sero-albuminous exudation was found between the arachnoid and pia mater of the left cerebral hemisphere. The brain itself was normal; its fibrous structure was so clear and well marked, owing to its firmness, that Professor Henle, who was kind enough to conduct the post-mortem examination, regretted that he could not make use of it for an anatomical demonstration. And for all that, there had been idiocy. However, on close examination the cause of the hemiplegia was discovered; in the middle of the left crus cerebri there were two encysted tubercles of the size of a thick pea, at a distance of a quarter of an inch from one another. This case shows how necessary it is to direct our attention to this important structure, which is traversed by all the great fibrous tracts passing to and from the cerebrum.

The degree and extent of the paralysis caused by compression, depends not only upon the capacity of the compressing medium, upon which generally most stress is laid; it is probable that the direction in which the pressure operates is a matter of still greater moment. This subject, which belongs to the yet unexplored field of the mechanism of cerebral action, might be partly elucidated by vivisections. Several accurate pathological observations prove, that upward pressure rarely induces paralysis, while it is commonly caused by pressure acting in the opposite direction. In proof of this we may point to tumours of the pituitary body, which sometimes attain such an extent as to displace the superincumbent parts, the lateral ventricles, the thalami optici and corpora striata. In the month of October, 1822, I was present at the post-mortem of a woman, aged 50, who for some time had been subject to amaurosis, fatuity, and during the last two months of her life, to epileptic seizures, which occurred especially at night. She had exhibited no trace of paralysis; a tumour of the size of a small apple was attached to the lamina cribrosa of the ethmoid bone and the sella turcica, and was so firmly adherent to them that it could only be partially removed. It weighed four ounces, and consisted of a cartilaginoid, yellowish tissue, traversed by white and bluish striæ. The pituitary gland and the chiasma of the optic nerves were not to be distinguished. The tumour had exerted such strong upward pressure, that the cavity of the ventricles was contracted to the size of a catheter. The anterior lobes surrounding it were extensively softened. The thalami optici and corpora striata were softened and flattened.

The cases given by Dr. Engel[1] in his work on the pituitary body and the infundibulum, corroborate this fact, and call to mind the circumstance that peripheral nerves passing over a tumour, and gradually stretched by it, suffer no interruption of their functions. We may also conclude from the experiments of Flourens,[2] that the effect produced by the tumour differs according as the pressure it exerts, acts in a vertical or a horizontal direction; longitudinal and transverse incisions were followed by different results; in the former case, however much the functions may have been disturbed, or even destroyed, they are restored; this never happens in the latter. Finally, in estimating the paralysing effect of pressure upon the brain, much depends upon the condition of the surrounding cerebral tissue. Inflammation and softening modify the paralysis, they may increase and even suddenly produce it; while on the other hand, the atrophy of the adjoining cerebral matter may cause the tumour to be long borne without any or but slight symptoms of paralysis.

Paralysis resulting from cerebral atrophy is congenital, or it is produced during the first year of existence, following an attack of convulsions and enduring through life. It may occur in the form of hemiplegia, and be complete or incomplete; in the latter case, the upper extremity is more paralysed than the lower. It is rarely confined to a single limb; sensibility is generally intact; contractions, especially of the flexors, are a common accompaniment. Atrophy of the paralysed parts is an invariable concomitant of the disease, and therefore pathognomonic; besides, it attains a degree unknown in any other form of paralysis. The extremities are wasted, and both shorter and thinner than the healthy limbs, and some of their parts are not perfectly developed. Not merely the cellular tissue and muscular fibres, but also the ligaments and bones take part in the atrophy. In persons thus afflicted, portions of the brain are found atrophied, or are altogether absent; the parts most frequently affected are the thalamus opticus, the corpus striatum, and the convolutions; it is unusual to find entire lobes atrophied. The colour and consistency is altered at the same time; the tissue is generally indurated, and of a yellowish tint. The empty space is filled with serum; not unfrequently the inner table of the cranial bones is thickened. Authors do not agree with regard to the condition in which they have found the nervous trunks of the paralysed extremities; some have observed them to be thickened, indurated, and of a yellowish colour, others describe them as presenting their normal appearance.

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[1] Ueber den Hirnanhang und den Trichter; Wien, 1839.

[2] Recherches Expérimentales sur les Propriétés et les Fonctions du Système Nerveux dans les Animaux Vertébrés; Paris, 1812, 2d ed., p. 107.

Etymologically speaking, it is atrophy of the brain upon which the paralysis depends which has been observed to follow the application of a ligature to the carotis of the opposite side, during the first week after the operation, and continuing until death. In some cases softening and atrophy were found, in others there was no disorganisation in the brain. The encephalon of a female is preserved in the Berlin museum, in whom Graefe tied the left carotid; eight days after the operation, paralysis of the right side had supervened; the carotid was found obliterated as far as the circle of Willis, and the cerebral substance surrounding the left fossa sylvii, was converted into a bladder of water. In one of the cases accurately described by Dohlhoff[1] eight days after the ligature had been applied to the right carotid, paralysis of the left angle of the mouth, of

[1] Rust's Magazin für die gesammte Heilkunde, vol. xxxix, 1838, pp. 501—510.

the left arm and leg, and of the bladder, supervened. Death ensued on the twenty-third day after operation. At the post-mortem, the calibre of the right carotid was found reduced to one half of that of the left, and there was softening in the centrum ovale of the right hemisphere and of the corpus striatum. In the other patient, a female, paralysis of the left arm and leg occurred on the third day after tying the right carotid. Death took place on the fifth day. On opening the cranium, all the contents were found gorged with blood; there was no perceptible difference between the right and left hemisphere.

Similar results were obtained in the experiments made by Sir Astley Cooper[1] upon living animals, in tying the vertebral arteries; only one or both forelegs were paralysed, according as only one or both arteries had become impermeable. The mere compression exerted by the finger produced similar effects.

There can be little doubt that impermeability of the cerebral arteries is a fruitful source of cerebral paralyses; but from attention having hitherto generally been diverted by other conditions ordinarily accompanying this morbid state, as hæmorrhage, hæmorrhagic cysts, softening or atrophy, we possess few instructive observations. Hasse[2] has recently published two cases of this kind with valuable commentaries. In the post-mortem details observers have only adverted to the incrustation and ossification of the arterial trunks and ramifications; they have neglected to attend to the obliteration of the ramifications resulting from stenosis or obliteration of the orifices of the vessels, which is of the utmost importance in a pathogenetic point of view; the vessels entering the corpora striata are both numerous and accessible to examination.

The opposite condition of congestion and hyperæmia of the brain has been so universally and readily admitted by medical men and the public, to be a cause of paralysis, that much prejudice has to be overcome before we can hope to arrive at a philosophical inquiry. I shall again advert to this matter when I discuss the general pathology of nervous diseases. Without laying much stress upon congestion at the surface of the brain under the existing relations of the circulation in the cranial cavity, we cannot deny that hyperæmia of the cerebral tissue, and especially when confined to a limited part, exerts a marked influence. Thus we often find a considerable circumscribed congestion, with small punctiform extravasations indicating the vicinity of an hæmorrhagic spot; it is not improbable that such a condition may recur several times, and be the cause of those evanescent attacks of paralyses which often accompany hypertrophy of the left ventricle of the heart.

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[1] Guy's Hospital Reports, vol i, p. 463.

[2] Henle and Pfeufer's Zeitschrift für rationelle Medicin, 1845, vol. iv, No. 1, p. 91.

We very rarely meet with cerebral paralysis of a regularly periodic type. Intermittent hemiplegia has been occasionally observed to accompany the febris comitata apoplectica[1].

Cerebral paralysis, like peripheral and spinal paralysis, is accompanied by disturbance of the antagonistic and symmetrical balance of the forces. We may expect that considerable progress will be made in our acquaintance with these phenomena, by the physiological observation of paralysis, for hitherto we have scarcely advanced beyond a knowledge of the facts that the action of the flexors predominates when the extensors fail to act, and that the face is drawn to the healthy side. I have already pointed out that the motor power, equally with sensibility, is in constant operation, even though we do not see or feel perpetual movement; this depends upon peculiar arresting agencies, among which the symmetry of balance is the chief. This function is in abeyance in hemiplegia, and abnormal positions and movements result. If the attack supervenes suddenly the individual falls over on the affected side; as the disease advances the patient in walking or standing inclines to the paralysed side; he is, as it were, pushed towards this side, and even in the horizontal position the body inclines that way. I have had repeated opportunities of convincing myself of this fact, and but very lately met with this phenomenon in an individual in whom cerebral softening had caused paralysis of the left arm and leg; when the nurse had previously placed him on his right side, the body turned to the left as soon as he went to sleep. A recent observer[2] has demonstrated that the rotatory movements in the direction of the longitudinal axis that occur in animals, in whom the crus cerebri or the optic thalamus has been divided on one side, are effected in a similar manner.

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[1] Werlhof; Opera Medica, edit. Wichmann, p. 66. [Febris comitata apoplectica, a term employed by Professor Romberg to designate a class of malignant fevers first described by Torti, Morton, and Borsieri.]—Ed.

[2] Lafargue; Essai sur la valeur des localisations encéphaliques, sensoriales et locomotrices, proposées pour l'Homme et les Animaux supérieurs; Paris, 1838, p. 17.

There are some peculiar movements which I have only observed in individuals labouring under cerebral disease, but which I am unable to explain upon the principle of disturbance either in the antagonism or in the symmetrical balance. One occurs in old hemiplegic subjects, and especially in those resulting from cerebral hæmorrhage. In walking they advance with the healthy foot, which forms the fulcrum of the body, while the paralysed extremity, with the toes pointed downwards, performs circular or semicircular movements slowly, and with a sort of slide. The other is met with in hydrocephalic patients, before the supervention of complete immobility, and has been accurately described by Gölis;[1] the patient in walking always crosses one leg over the other, for instance he places the right foot invariably before the left one, and the latter again before the right foot; in doing this the front of the foot is turned inwards, the individual generally stepping upon his toes, and but rarely upon the external margin of the entire sole; the large toe of one foot strikes against the Achilles-tendon of the other.

The consecutive changes produced in the hard and soft parts of the paralysed extremities in consequence of the immobility are the same in cerebral as in spinal paralysis. Persistent contraction of the flexors is more frequent in this case, and should not be confounded with the transitory and painful contractions of the muscles in inflammatory softening; this contracted state sometimes gives rise to stiffness, and even to anchylosis and consequent deformity of the joints; when this takes place emaciation ensues more rapidly and in a more eminent degree.

In our treatment we should always have regard to this secondary effect; the more so as it may have become isolated by arrest of the cerebral disease, and may be perpetuated as an independent affection.

The other rules applicable to the treatment of the cerebral affection upon which paralysis depends will be considered under the head of the formative diseases of the nervous apparatuses; I may however allude to the influence exerted by the spontaneous cure of hæmorrhage and softening of the brain, upon the cure of paralysis. The analysis of my own observations and those of other writers has convinced me that this process bears no direct relation to the recovery from paralysis. In thirty-four cases that I have collected, the paralysis was found to have disappeared in ten, in six it was diminishing, and in eighteen it continued unchanged up to the period of death, although in several of those belonging to the last category, the cavity had closed, and was almost cicatrised. The condition of the surrounding cerebral layers is of more consequence than the size of the cavity; in the cases of complete recovery they presented a normal texture; but where there was even a trifling residue, a cartilaginous induration of the adjoining parts appeared to have maintained the paralysis unaltered; in one of my cases it had done so for five, in another for ten years. It has not been determined whether the seat and direction of the hæmorrhagic cysts exert any influence, but it is probable that they do so.

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[1] Praktische Abhandlung über die vozüglichsten Krankheiten des kindlichen Alters, vol. ii, p. 42.

Paralysis, the diminution or loss of motor conduction in the central fibres of the brain, must be distinguished from the diminution of the force which regulates the co-ordination of the movements, that force which appertains to the brain as a central organ. This affection is characterised by a loss of balance, and of the due harmony and succession of the muscular contractions necessary to effect movements. In man the expression of these phenomena is more manifestly rendered in the inferior than in the superior extremities. The individual is unable to stand erect or to walk in a straight line; his gait is rolling, even when the body is supported by others. In ordinary walking, the support of the body and the pendular movements of the lower extremities are two elements which are essential to progression; the rhythmical action of the feet is impaired in the cases under consideration; owing to the interruption of the pendular movement, or of the curling off of the foot from the ground, we must ascribe the frequent tottering and stumbling of the affected individual (titubatio). By this means we establish clearly the contrast between the diminution and the morbid exaltation of the co-ordinating function, which was treated of at page 166.

This condition rarely continues isolated, except in cases of blood-poisoning which involve the brain, as in typhus, poisoning with opium or alcohol, or the first stage of meningitis. It is generally complicated with or passes into paralysis, as we have an opportunity of observing in diseases of the cerebellum and the base of the cerebrum.

I shall conclude the consideration of cerebral paralysis with the description of that form which is subject to the influence of the brain, as the organ of the mind.

We have repeatedly adverted to the important part borne by the sensorium in disease, in the manifestation of sensation and motion, see vol. I, pp. 95, 158, 196. I have selected the term *psychical spasms* for those which are produced by the stimulus of a mental impression (vol. II, p. 178). In the same way we meet with psychical immobility and paralysis, which depends upon some derangement of the intellect; this is rarely hyperstimulation, but generally a depressed condition of the powers of the will. A species of monomania, however, occurs, in which the individual considers himself condemned to utter immobility, which if persistent is followed by the same results as the entire loss of the motor conducting power. Cruveilhier[1] relates a case of this kind which occurred in a young woman; for two years she had been confined to her bed, and was considered paraplegic; her legs became atrophied and cold, when she attempted to stand up her knees gave way, and if she tried to walk she dragged them after her like paralysed limbs. The circumstance that tickling the sole of the foot was so disagreeable to the patient as to cause her to execute rapid voluntary movements, in order to avoid the titillation, excited suspicions, and by the application of suitable treatment the immobility was overcome. The delusion under which some insane persons labour, that their legs are made of wood or glass, also induces immobility; it is, however, most frequently found associated with congenital or acquired idiocy, and is induced by an absence of the power of determining movements, much in the same way as in the animals in which Flourens removed the cerebral lobes.

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[1] Anatomie Pathologique, livr. xxxv, p. 4.

Independently of this we meet with a peculiar species of paralysis in insane persons, which manifests itself in the articulating movements of the tongue and lower extremities. Esquirol[1] was the first to direct attention to the subject; his pupil Calmeil[2] has written the best monograph upon it, and it has also been studied by Bayle[3] and Parchappe.[4]

This form of paralysis commences with a difficulty of speech. Articulation is no longer clear; the insane person is forced to make an effort in order to speak; the words fail him; he talks thick, like a drunken person, but the movements of the tongue and the lips are in no way deranged. When the individual is excited his speech is rendered more fluent than it is in calm moments. The inferior extremities become weak, and their movements exhibit an absence of coordination. The gait becomes tottering and insecure, especially when the patient is walking slowly. When he wishes to walk from one place to another, he is obliged to give himself an impulse repeatedly, which renders his mode of progression the more peculiar. When complicated movements, such as climbing or jumping are attempted, the exertions made to achieve them bear no relation to the result attained. When the patient has fairly commenced to advance, he can accelerate his movements, and even run; when lying in bed, so that the trunk is supported, he has no difficulty in moving his feet. As the disease advances articulation becomes still more limited and very indistinct, it is almost necessary to guess the words; the legs are almost deprived of their power to support the body. When the insane person rises from his chair and walks, he rests his hands upon the back of his chair, raises himself up slowly, and, like a child that is measuring its first steps, bends to the right and bends to the left, then makes an attempt, and drags himself slowly along in a zigzag direction. He stumbles over the most trifling impediment, and is constantly tumbling down.

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[1] Les Passions considérées comme Causes, Symptomes et Moyens curatifs de l'Aliénation Mentale; Paris, 1805.

[2] De la Paralysie considérée chez les Aliénés; Paris, 1826.

[3] Traité des Maladies du Cerveau et de ses Membranes. Maladies Mentales. Paris, 1826.

[4] Recherches sur l'Encéphale, sa Structure, ses Fonctions, et ses Maladies, Deuxième Mémoire; Paris, 1838, pp. 141—176.—See also Esquirol; Des Maladies Mentales; Paris, 1838, vol. ii, pp. 263—282.

The sense of weakness and disturbed balance is so great, that the patient seeks to hold on to the nearest object. The upper extremities also begin to participate; there is much helplessness, and the hands can only with difficulty be raised up to the head. The cervical muscles and the muscles of the neck lose their power; the chin sinks upon the chest; the sphincters are paralysed. When the disease has attained its highest pitch, the patient cannot articulate at all, and movements become impossible, even when the body is supported. Mastication and deglutition are impeded, the morsel sticks in the throat. Convulsions of a local or general character, and epileptic attacks, frequently supervene upon this paralytic condition, and especially towards the close of the disease. Sensibility is rarely affected to the same extent as motility; the obtuseness or loss of sensation appears to depend less upon the incapability of conduction than upon an impaired perceptive power. The relation in which insanity and paralysis stand to one another varies. Both mania and monomania enter into combination with it, and they do so more commonly in the advanced stages than at the commencement of the disease. The delusion very often refers to the possession of enormous wealth, of high places of distinction, and luxurious objects, though, as Bayle has demonstrated, by no means exclusively. Paralysis rarely associates itself with monomania of a negative character, or melancholia; it is most frequently complicated with dementia, which either presents features of obliviousness and incoherence of thought, and the entire absence of mental combination; or forms the termination of mania in a complete ruin of the psychical powers. The influence of maniacal excitement, which may break out in the most utter idiocy, upon the paralytic phenomena, is remarkable; during such attacks speech becomes fluent, and the gait rapid. It is only during the last period of existence that the maniacal expression is confined to screaming and a violent movement of the extremities.

The duration of the disease extends from one to three, and in solitary cases, from five to six years. It almost invariably terminates in death, either suddenly, by apoplectic or epileptic seisures, or more frequently, by gradual exhaustion from diarrhœa, dropsy, or marasmus.

Several French physicians lay great stress upon a softening of the superficial layers of the grey matter of the cerebrum, which is one of the post-mortem appearances met with in connection with dementia; it generally occurs in complication with adhesions of the pia mater, so that when this membrane is detached the cortical substance adheres to it in patches, causing the surface of the brain to present a more or less eroded or granular appearance. Even when there are no adhesions, this softening may be shown to exist within the grey substance. Calmeil's[1] investigations have shown, that beyond an accumulation of serous fluid, that varies in amount, no marked alterations are found in the spinal canal.

The male sex is more predisposed to this form of paralysis than the female; this is well shown in Paris, in comparing the male lunatic asylum of Bicètre with the one for females at the Salpetrière. Calmeil states the proportion to be among the male insane as 1 to 15, among the females as 1 to 50. The predisposition is greatest between the 30th and 50th years of life. Persons of robust constitutions are more exposed to it than delicate individuals. Climate appears to exert some influence upon the disease; it is less frequent in the south than in the north. Esquirol met with very few paralytic subjects in the Italian madhouses. This complication appears more common in France, than either in Germany or in England. The wealthy are more subject to it than the poor, the higher orders of society more than the lower, and those ranks, *e. g.* in the army, in which there is much room for the play of ambition, and where there is great temptation to debauchery, are peculiarly prone to it. Venereal excesses and intemperance frequently give rise to the affection.

This form of paralysis clearly proves the great importance of an accurate knowledge of disease, to enable us to give a prognosis. The condition of a lunatic, his age, the short duration of the insanity, may excite very strong hopes of his recovery; but if we find a retardation of the articulating movement, though but temporarily, yet suddenly arresting his voluble gossip, the foundation of this overwhelming species of paralysis is laid, and we are justified in pronouncing the verdict of incurability, strange as it may appear to one ignorant of the nature of the malady.

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[1] Loc. cit., p. 371.

For the consideration of the treatment, the reader is referred to the chapter on dementia in a future volume.

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[1] The Original contains no Index, the Editor therefore is alone answerable for the one appended to the English edition.

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ERRATA TO VOL. I.

Page 159, line 13 from foot, *for* passed, *read* pressed.
„ 192, „ 2, *for* condensing, *read* conducting.
„ 194, „ 5 from foot, *for* unimpaired, *read* impaired.
„ 196, „ 6 „ *for* and the head, *read* when the hand.
„ 241, last line, *after* intervals, a semicolon; *after* patients, a comma.
„ 251, „ *read* anosmia.
„ 252, line 5, *for* rapid, *read* sapid.

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